INVESTMENT MANAGEMENT AND THE COMPUTER: LIMITATIONS AND PROSPECTS

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PREFACE

The research reported in this dissertation arose out of a desire to investigate the limitations and capabilities of the electronic computer as a tool of investment management.

The very nature of this project precludes any hard and fast proofs and must be to some extent the result of my own reasoned judgment, but it is hoped that this research sheds some light on the optimal man-machine relationship in this very important sector of our economy.

The research project which formed the basis of this report actually began during my graduate studies at the University of Pittsburgh where I loaned a linear programming program that I had written to a fellow student. I forgot to warn him of a serious limitation of the program (no degeneracy stop) and his problem caused the computer to cycle continuously until the console operator finally stopped it. This incident aroused my curiosity about the limitations of the computer programs which were written for investment management purposes but are being used by persons who did not write the program themselves and may not even know very much about computers.

Preliminary work on this project was continued while I was a faculty member at Gannon College and while I was a graduate student at the University of Florida. The project was completed after I joined the faculty at the University of Georgia.

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The essence of investment management is the selection of efficiently diversified portfolios of securities, at a given time, the moment of selection, which are expected to accomplish the investor's goals, usually to obtain the highest return possible on his investment while not exceeding some specified level of risk exposure. The problem of the investment decision maker is to allocate a limited amount of investible funds to those few securities, from among an almost infinite array of alternatives, which appear most likely to do the job over some period of time in the future.

A model, suitable for computer implementation, given some input data concerning present security prices, expected prices, expected dividends, expected variance in the price and dividend estimates, and

expected covariance between and among each and every security, exists and has been widely acclaimed as a theoretical construct but so far has not been put into regular use by institutional investors, primarily because of a lack of top management understanding, acceptance, and support.

This study seeks to fill the present information gap by presenting the results of a simulation of the model's efficacy over three ten-year (1956-1965, 1957-1966, and 1958-1967) performance periods, using historical inputs. Seventeen portfolios are compared in terms of both realized holding period return and risk with both the equal dollar and equal shares buy and hold strategies. One portfolio, chosen ex post, represents optimal performance; another represents minimal performance. Two, ex ante, portfolios representing "market" performance, two representing mutual fund performance, and five portfolios chosen randomly from the 665 sample stocks are compared with six portfolios chosen by the computer implemented model. A further comparison with actual results of 100 large mutual funds is also made. In all cases the performance of the computer selected portfolios is statistically significantly superior to that of any and all others tested. Neither of the two strategies, equal dollar or equal shares, is statistically superior to the other.

The results provide sufficient evidence for acceptance of the primary hypothesis that the model could have been used during the late 1950's to select portfolios for institutional investors which were superior to those actually selected. The secondary hypothesis that the Standard and Poor's Stock Ranking is an operationally effective risk measure is also accepted. Extensive portfolio turnover, such as that which is often employed by many mutual funds, is shown to be dysfunctional behavior on their part, as is also the observed tendency of

such investors to overdiversify their portfolios by holding an excessive number of issues. Since historical inputs are used and superior performance results, the random walk hypothesis of stock price behavior which asserts that past data cannot be used to predict future prices is refuted.

The only significant limitations of the model uncovered by this study were: that it is not suitable for frequent use by speculative traders because it is intended for single point in time decision making and its cost per use is still rather high, and that it cannot be used by (those rare) investors who need to impose nonlinear constraints on their decisions.

The prospects for future use of the model are quite bright if more institutional investors begin to use the model, as this study indicates that they should. They can expect higher returns at less risk than they can achieve without the model. Gradual evolution toward an optimal man-machine investment management system is foreseen, with man handling the qualitative aspects of the decision making situation and formulating the appropriate constraints while the computer performs the quantitative activities.

CHAPTER 1

INTRODUCTION

The essence of investment management is the proper selection of portfolios of securities. This is a complex decision making problem which requires the allocation of limited investment funds to only those few securities, from among an almost limitless array of possible alternative securities, which, at a particular time, the moment of decision, appear to the decision maker to provide the highest probability of achieving his investment goals over some period of time in the future. The decision maker must select his portfolio on the basis of his best estimates of future performance, which are, in turn, based upon incomplete information. He must frequently accomplish this difficult task under time pressure since prices of securities change frequently and a security which is a good buy at one price may not be at another price.

Most writers on the subject of investment management have distinguished two major phases of the investment management process: financial, or security analysis and portfolio selection. Financial analysis is concerned with the characteristics of individual securities and provides the necessary input data for portfolio selection. Portfolio selection must consider the expected performance of several securities as an integrated entity, the portfolio, which is most likely to achieve the investor's goals. Since each of the securities included in a portfolio interacts with and complements the others it is not possible to select an appropriate portfolio merely by collecting a number of securities which have been classified as "good" by financial analysis.

Since electronic computers have been used for business data processing purposes since 1954 and, with the passage of time, have become both more reliable and much cheaper, thus encouraging users to find even more work for them to do, it is reasonable to inquire into their usefulness within the investment management process.

The first modern electronic computer was invented in 1946 as the result of an effort to build a faster calculating machine for the engineer developing weapons. This machine was only a super desk calculator, containing thousands of vaccuum tubes, which could do in seconds, by itself, what a man with a desk calculator needed days to complete. Gradual improvements in operating speeds and memory capacity were made and business firms began using computers for data processing applications in 1954.

Computers are a new kind of tool, which can be used as an extension of the brainpower of man, but they can not think and must be supplied with a very detailed program of instructions which tells the machine just what to do, exactly how to do it, when to do it, and what to do when it is finished. The memory capacity and calculational speed of modern computers far exceed that of humans and they do not become fatigued by working long hours as mere mortals do.

Computer programs for financial analysis and portfolio selection are readily available to computer users since some of the computer manufacturers provide "canned" programs, free of explicit charges, to their customers for these functions. Other such programs can be obtained from independent companies or can be custom made by the programming staff of the computer user.

Appropriate data for these programs must also, obviously, be available if practical operations are undertaken. The Standard Statistics Corporation sells a magnetic tape, computer ready, data base, called

COMPUSTAT, which contains annual financial data for nine hundred large, well-known industrial firms.

No large financial institution in the United States regularly uses computers for investment management operations on a day to day basis. Only a few institutional investors have experimented with such computer applications and few of these firms are willing to publish the results of their investigations.

The most important reasons for the observed non use of computers for portfolio selection problems have been: computational costs, lack of appropriate data, and lack of management understanding, acceptance, and support for computer assisted decision making. Persons who presently make portfolio selection decisions are also fearful that computers might replace them. The continuing decline in computational costs and the availability of the COMPUSTAT annual and quarterly data bases at reasonable prices appear to effectively remove these first two major inhibiting factors.

This study seeks to provide the basis for managerial understanding, acceptance, and support by reporting the results of a simulation study of the Markowitz portfolio selection model which indicates that the portfolios chosen by the model were significantly superior to both random portfolio selection and human portfolio selection, as represented by a sample of one hundred large, well-known mutual funds, in terms of cumulative holding period returns (capital gains plus dividend income), at specified levels of risk exposure.

The Markowitz model is widely acclaimed and accepted as a theoretical construct which explains the efficient diversification of investment portfolios by investors who like return but dislike risk. It was first proposed by H. M. Markowitz in 1952 [1] and later expanded by him in 1959 [2]. The mathematical procedure was, at that time, too complex (for even

the largest computers then available) to apply to practical problems. The theory has been extended even further by Tobin [4] and Sharpe [3], among others, so that it has been feasible to apply it to practical problems since 1964 when both the required programs and data base became generally available for second generation (solid state) computers of sufficient size.

The objective of this dissertation is to contribute to our knowledge of the practical efficacity of the Markowitz model by subjecting it to empirical tests using the same data base and computer programs generally available to large financial institutions. The specific hypothesis tested by this research project is that this model could have been used during the late 1950's to make portfolio decisions for institutional investors which were superior in terms of realized returns at specified levels of risk exposure to those actually made.

The realistic empirical tests of the model, which are reported in Chapter Five, utilize a relatively new research technique, simulation, to ascertain the ex post performance of portfolios selected by the model and by several other methods.

Since the model is intended for single point in time decisions for selection of portfolios to be bought and held for specified time periods it is most appropriate for long term investors rather than speculative traders.

The empirical tests, therefore, assume that an investment of $100,000 is made in seventeen portfolios under both the equal dollar and equal shares buy and hold strategies at the beginning of a ten-year period with the portfolio being liquidated at the end of the ten-year period. The seventeen test portfolios include two mutual fund portfolios, two market index portfolios, five randomly selected portfolios, six computer

selected portfolios, an ex post optimal portfolio, and an ex post minimal portfolio.

The minimal portfolio, composed of the twenty sample stocks which had the lowest returns for the ten-year period, indicates the "worst" performance which could have occurred over this time period. The optimal portfolio, composed of the twenty sample stocks which had the highest returns, indicates the "best" performance which could have been obtained during the ten years. All other portfolios will have performances between these limits. The two market index portfolios include, in one, the thirty Dow Jones Industrial Average stocks, and in the other the twenty-five stocks included in the New York Times Industrial Index. They indicate "par" performance which the portfolio managers should aspire to exceed. The five random portfolios were selected from the sample stocks by a simple random selection process to indicate "chance" performance. The two mutual fund portfolios are those of the only two funds which have actually employed a buy and hold strategy during the post World War II period; one invests new funds in equal dollar amounts while the other buys an equal number of shares of the stocks on its portfolio list. These portfolios are used as reference portfolios for the computer selected portfolios which are chosen to provide higher return at the same level of risk as the reference portfolios. The performance of the computer selected portfolios is also compared with that of one hundred mutual funds which did not follow the buy and hold strategy.

This study uses a much larger sample than any other previous study. The basic sample includes 665 firms. This sample was reduced to 300 for the final selection runs because this was the largest number that the computer used for this study could handle at one time. The 1946-1955 time period was used as the data base for a mechanistic security analysis

procedure which extrapolated the 1946-1955 performance into the future. Three ten-year performance periods, 1956-1965, 1957-1966, and 1958-1967 are used to evaluate the performance of the portfolios.

In each of the three performance periods the computer selected portfolios significantly exceeded the performance of the random, mutual fund, and market index portfolios. In every case the computer portfolios provided at least twice as much return at the same or lower level of risk exposure, as measured by the portfolio risk index. This outstanding and consistent performance was statistically significant at the .01 level, thus virtually ruling out any possibility that this superior performance was a chance event. The performance of the one hundred mutual funds was not significantly different from that of the two mutual fund reference portfolios.

These empirical tests, utilizing a much larger and more representative sample than any other published study, with a mechanistic security analysis procedure, provide, for these performance periods, an affirmative answer to the empirical question: Given some method of security analysis does the Markowitz model provide portfolios which outperform those selected by other methods?

The mechanistic security analysis procedure used in this study minimizes the effects of security analysis on the portfolio selection results. It is possible that experienced security analysts, such as those usually employed by institutional investors, could provide more accurate forecasts for use with the Markowitz model which might lead to even better results.

Chapters Two and Three provide background information on the institutional investment management process and computer assisted decision making. A survey and synthesis of the theory of portfolio selection is

provided in Chapter Four. Chapter Five presents the results of the simulation study and discusses some of their implications. Chapter Six provides a summary of this research project and a discussion of the important limitations and prospects of computer assisted investment management decision making. The appendices provide more detailed information about the samples and the individual portfolio results.

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CHAPTER 2

INSTITUTIONAL INVESTMENT AND THE COMPUTER

Introduction

This chapter provides background information about the institutional investment decision making process, the increasing importance of institutional investors in the United States, and computer usage within these institutions.

Financial institutions act as middlemen in the economy by bringing together the suppliers and the users of capital funds, thus contributing to the economic activity of the nation. They provide a convenient medium for gathering regular and relatively small amounts of personal savings from many widely scattered individual savers. These funds are then combined into relatively large amounts of money which can then be made available, in economical transactions, to business firms who desire to make real investments. This process of real investment by business firms is accomplished by means of the financial investment of the institutional investors as they purchase newly issued debt (bonds) or equity type (stocks) securities. Even though financial institutions do not always and only purchase newly issued securities, they still facilitate the real investment process by actively participating in the secondary market for already outstanding securities, thus providing the necessary liquidity for the original individual investors who may later wish to dispose of their investment securities.

Included among the financial institutions which perform this important function are: commercial banks, savings banks, trust companies, savings

and loan associations, credit unions, pension funds, life insurance companies, casualty insurance companies and investment companies. In this study it is the common stock investments of the institutional investors which are of primary interest, and the investment companies are considered to be the most representative single institution of the entire group.

Collectively, all of these financial institutions owned or controlled (exercised investment decision making responsibility) approximately 30% of the dollar value of all outstanding common stock in the United States at the end of 1965 [1, p. 726]. This is a much larger share of the total than the financial institutions accounted for twenty years ago, and they are expected to own and/or control an even larger share of the total outstanding common stock in the future.

These financial institutions operated only 18% of all the computers in the United States in 1966 (measured by value of installed machines) but they are expected to also greatly expand their share of the computer total in the relatively near future. If the fact that manufacturing firms tend to use scientific computers which are faster and more expensive than the business computers usually used by non manufacturing firms is taken into consideration, it is now thought that the financial institutions probably operate one fourth to one third of the total number of computers installed in the United States [4, p. 194].

The Institutional Investment Process

The institutional investment process is an unending cycle which is originally triggered by funds which become available for investment. It proceeds through the steps of forecasting the future, analysis of investment requirements, formulation of investment policy, search for relevant alternatives, security analysis, portfolio selection, and portfolio analysis. This loop is sometimes shortened in actual practice, going from portfolio analysis to security analysis to portfolio selection and back to portfolio analysis again, especially if the investment requirements and policy remain unchanged.

Most institutional investors have regular daily inflows of new funds which they seek to invest as soon as possible since no return can be obtained from cash assets. It is often desirable to forecast the amount which is expected to flow in and out over a particular planning period so as to be better able to make transactions of an efficient size. In addition, most of the institutional investors continually make short term forecasts of the expected amplitude of changes in market rates of interest, security prices, and stock market indices to guide them in the timing of their investments. Knowledge about the magnitude and timing of investible funds enables the decision maker to decide how much effort to expend on the other steps in the process.

The next step, analysis of the investment requirements, often can be performed at rather infrequent intervals. Since an almost infinite variety of securities with different characteristics is available some method of narrowing the scope of later analyses is needed. Some securities provide

greater income prospects while others provide greater capital gains prospects. The obligations of the institutional investor to its own suppliers of capital will have a bearing on its need for liquidity and current income from its portfolio. This in turn will affect the mix of securities which it will consider for inclusion in its portfolio.

The requirement for liquidity is primarily affected by the requests for redemption made by investors. Past experience should be useful to the decision maker in determining the acceptable amount to be kept in cash and/or in short term securities which are readily convertible into cash with minimal probability of loss of principal. The requirement for current income versus capital gains is affected by the opinion of the investment managers concerning the tax status of investors and their other sources of income. The requirement for principal stability is affected by the investment manager's perception of the personality characteristics of the investors and the likelihood that certain securities might have to be sold at market prices lower than those in effect when the securities were purchased since losses can be realized only when securities are sold [11, p. 343].

The ability of the individual investor to risk loss of principal depends on the size of his portfolio and the nature and magnitude of his other sources of income. For most investment companies all of their assets are invested in portfolio securities and there is no other source of income. If their portfolio should shrink in value, their stockholders might sell, forcing them to sell portfolio securities and further reducing the size of the portfolio, in a possibly continuous cycle resulting in the demise of the company. Apart from this possibility, the likelihood of the sale of a depressed security depends on the volatility of that security itself, and the urgency of the need for funds to meet stockholder demands

when the price of such a security is low.

These factors can be evaluated, along with the quality of the management team of the investment company, to determine the degree of risk which should be assumed by the portfolio. The basic portfolio risk is that of not meeting the stated objectives because the securities which were purchased did not perform as expected.

The next step in the process is the formulation of the policy which will be followed in managing the portfolio. The policy is generally a written statement concerning actions to be taken from time to time in selecting securities for purchase or sale and in deciding when such actions will be taken. The policy frequently specifies that only securities of certain risk classes (typically the top 4 of 9) may be considered, and requires or prohibits investments in certain industries or types of securities. The overall character of the investment policy is usually specified as either aggressive, defensive, or neutral. A defensive policy is one which is designed to minimize the potential losses from changes in market prices by selecting stable securities, an aggressive policy attempts to maximize potential gains by selecting volatile securities, while a neutral policy seeks a balanced approach [11, p. 393].

After the broad policy has been formulated it is possible to proceed to the next step, that of searching for attractive alternative securities which generally meet the policy requirements. If the policy, for example, calls for investment in common stocks rated B+ to B- all other securities can be ignored and only the stocks of these ratings need be further analyzed.

The next step, security analysis, attempts to grade securities which meet the broad policy specifications and arrive at a valuation for them. Financial statements provide the basic raw material at this stage for quantitative analyses which are supplemented by qualitative data which

are primarily concerned with appraising the quality of the management of the firm being evaluated. The objective of security analysis is to arrive at some estimates of the firm's future dividend (or interest) payments, and the probability distribution of these future payments. This valuation establishes the expected price of each security at the end of some time horizon relevant to the investor.

The next step, portfolio selection, is the aspect of the process of primary interest in this study. It uses as inputs the estimate of the future return from holding the security for some period and the estimate for the variance of this return plus an estimate of the covariance among the returns of various securities, to select a diversified portfolio appropriate for the investment objectives of the investor. The future return includes the periodic income during the holding period plus (or minus) the capital gain (or loss) when the security is disposed of at the end of the period.

The last step, portfolio analysis, is concerned with ex post portfolio performance in relation to the objectives specified in the policy statement. It is usually performed periodically and sometimes reveals securities which have not performed as well as expected. These then become candidates for sale if securities with better prospects can be found.

The financial institutions which implement this process of investment management decision making tend to be rather large (in terms of total assets), to use large staffs of investment specialists, to limit their interest to stocks of large companies which have large amounts of outstanding stock for which considerable information is available, and to use committees to actually make the policy decision [7, p. 80-83].

The committee process takes time and the cumulative character of the investment previously made plus the amount of new funds available for

investment affect the speed with which adjustments can be made in the portfolio as changing conditions might require. The information which is perceived by the analytical staff and the committee to be both available and relevant plus their attitudes toward risk affect the entire investment process.

Investment companies (mutual funds) are the major type of institutional investor in common stocks for which considerable information is readily available. Because of this and the belief that they are typical of all institutional investors in this area of decision making, they are used as subjects for the empirical tests reported later in this study. Among the other institutions, pension funds and trust funds have the most nearly comparable decision situation but limited data are available on their activities and performance.

Each investment company sets its own policies within the guidelines specified in the Investment Company Act of 1940 and it has been said that no two mutual funds are alike in their investment philosophies [3, p. 31]. However, since almost 300 mutual funds currently exist, it is logical to expect that there will be some similarities which will make it possible to classify funds into a few groups so that some comparisons may be made.

The Investment Company Act requires diversified investment companies to diversify at least 75% of their assets with not more than 5% of their assets invested in the securities of any one issuer. In addition to these legal constraints, the directors of most investment companies impose further limitations on the investment policy of their own firm, such as requiring or restricting investment in certain industries. In practice most institutional portfolios include more than twenty companies.

The Institutional Investment Environment

Financial institutions have recently been growing at a far faster rate than non financial firms. When any firm grows it must acquire the assets necessary for the conduct of its expanding business, and the growth of non financial firms can therefore be measured primarily by the increases in physical assets which occur over time while the growth of financial firms is primarily measured by the increases in financial assets (securities) they acquire. Thus it can be said the growth of financial firms requires them to purchase securities while the growth of non financial firms requires them to sell securities in order to raise the funds with which investments in physical assets are made [6, p. 478].

Financial institutions have been growing faster than non financial firms not only because savings have grown absolutely but also because their share of these growing amounts has risen sharply since many individuals who previously invested for themselves now do so through the institutions. In the post World War II period, for instance, a relatively new type of financial institution, the corporate pension fund, has become a strong demander of common stocks. Other institutions, such as life insurance companies, have devoted increasingly larger portions of their new funds inflows to common stock investments. The investment company industry has grown from less than half a billion dollars of assets in 1940 to almost forty-five billion dollars at the end of 1967 and much of this unprecedented funds inflow has been invested in common stocks [3, p. 10].

Since 1958, the financial institutions have been buying, usually from individuals, more common stock than the total value of net new stock

issues [6, p. 479]. This institutionalization of common stock investment is expected to continue, as it has for corporate bonds, over the foreseeable future (in 1900, institutions held only 35% of all of the outstanding bonds; now they hold about 95%). The financial institutions, although they owned only 7.6% of the total outstanding common stock in 1900 and 20.5% in 1952, are expected to own approximately 30% by 1975 [5, p. 489]. Common stock investments controlled by financial institutions, mainly trust accounts for which the trustee (usually a bank) has discretionary or advisory investment powers, are also increasing, and may bring the total outstanding common stock subject to institutional investment decision making power near 75% of the total outstanding common stock in the nation by 1975.

This increasing institutionalization of investment has also been accompanied by an increase in the absolute number of individual investors from just over six million in 1952 to slightly more than twenty million persons in 1965 [10, p. 35]. These individuals tend to hold fewer shares of any issue than previously was the case while the institutions hold more; in addition, both classes of investors tend to make transactions more frequently than had been the case in earlier years. This tendency toward ever increasing transactions volume has been especially noticeable during 1968 when several single day trading volume records were established and the markets were forced to curtail trading hours so member firms could try to keep up with the unprecedented volume of paperwork. Average daily trading volume on the New York Stock Exchange (the major stock exchange) has been in a long term upward trend which has accelerated significantly since 1965 [10, p. 63].

Therefore, in spite of the increasing institutionalization of investment which might be expected to lead to fewer transactions of larger size

each since the institutions do not need to make so many odd lot transactions, total trading volume is increasing rapidly, largely because an increasing number of small investors are becoming interested in the stock market. We are now in the third year of this unprecedented and largely unexpected (by investment banking firms) development which is exerting considerable pressure on both the investment banking industry, which handles most of the transactions, and the investment management industry, which makes most of the investment decisions, to utilize computers just to keep up with the ever increasing volume of required bookkeeping.

If these financial firms follow the same path already taken by the more sophisticated computer users they will expand their own usage of computers by increasing the number of applications for which their computers are used [2, Ch. 25]. A basic reason for the rapid proliferation of computer applications which has so far been observed is that presently available computers are approximately one million times faster at only one hundredth of one percent of the cost of a human clerk performing arithmetic operations [8, p. 41].

Computer Usage by Institutional Investors

Since no published data were available to indicate the extent to which these financial institutions used their computers for investment management rather than routine data processing operations, a sample survey was conducted by Kahl [4] during 1966.

A total of 150 questionnaires were mailed to a random sample of financial institutions selected from a list of the largest commercial banks, savings banks, savings and loan associations, life insurance companies, property and casualty insurance companies, and finance companies located within the continental United States.

Replies were received from 112 firms, or 74.7% of those querried, and indicate that computers are indeed quite pervasive, with 85 (75%) of the firms using at least one computer and five (4.2%) also making regular use of a service bureau.

Over half of the responding firms (55.9%) have used computers for 3 to 5 years. In spite of this relatively short time, the importance of the computer to these firms is apparent from the organizational position of the top computer executive in the firm. Many of these firms (22%) have created a Vice President for Data Processing position which directly supervises the computer function while 78% of the firms have the computer under either a functional Vice President or the Chief Financial Officer who, in turn, reports directly to the President. In all of these firms the computer function provides its services to all parts of the firm.

The responding firms reported that they were able, with the computer, to provide improved services to their customers with increased efficiency

and that new and better (more up-to-date) information is now available for management decision making purposes.

The survey revealed that only 30.7% of the responding firms now use computers for portfolio evaluation (analysis) purposes while another 31.8% intend to do so by 1975. Security analysis is now performed with the aid of computers in 17.0% of the firms while another 34.1% plan to do so by 1975. These functions were uppermost in the near future planning of the responding firms, with credit evaluation close behind. It appears, therefore, that we are on the threshold of much more widespread computer usage in the financial industry [4, p. 198]. Table 1 presents a detailed summary of the present and expected future computer usage by responding firms.

Obvious preconditions to widespread use of computers in the investment management process are the availability of computers, programs for the various functions such as security analysis and portfolio selection, and the necessary computer ready data.

Computers have been, and continue to be, available to firms in the financial industry, and since the majority of them (72.3% in 1965) are produced by IBM the programs utilized in this study are also available. The data problem, although not yet completely solved, is apparently well under control since COMPUSTAT was announced in 1964. As the services provided by COMPUSTAT are broadened, availability of the hardware, software, and data will cease to be limiting factors, leaving only the shortage of appropriate personnel and the lack of top management understanding, acceptance, and support as impeding factors to more widespread intensive and extensive computer usage.

Computers can be employed to assist investment decision makers in each step of the investment process. If any models are used for fore-

TABLE 1

SPECIFIC COMPUTER APPLICATIONS BY RESPONDING FIRMS, PRESENT AND FUTURE

(in Percentage of respondents reporting)

Specific Computer Application	Present (1966)	Future (1975)
Interest Calculation	70.5	83.0
Payroll	69.3	89.3
Deposit Accounting	62.5	71.6
Mortgage Accounting	59.1	83.0
Installment Loan Accounting	53.4	62.5
Premium Accounting	43.2	59.1
Portfolio Evaluation	30.7	62.5
Float Analysis	28.4	46.6
Trust Account Accounting	27.3	43.2
Charge Account Accounting	22.7	31.8
Credit Evaluation	20.5	31.8
Security Analysis	17.0	51.1

Source: Kahl [4, p. 196]

casting purposes they can be programmed so it is only necessary to provide appropriate input data in order to get forecasts. This will probably result in decision makers having access to these forecasts faster than was previously possible.

If the analysis of investment requirements can be reduced to an algorithm, then computers can be programmed to perform this function. At least one such algorithm is available in published form [11, Chapter 15] but has not yet been programmed for computer use. Once it is, the decision maker need only supply input data to get the desired outputs. Once again computers could perform this function faster than presently.

Likewise, the formulation of policy stage might be reduced to an algorithm so a computer could be employed. This is conceptually and technically possible now, but has not yet been done. Policies presently are established by experienced investment personnel who employ large amounts of personal judgment in this process.

In the search for attractive investment alternatives computers can be and are now being used to separate out those securities which obviously do not fit the policy specifications, or some other specified criteria. This also would speed up the overall process and get information to the decision makers faster than other methods.

Since considerable mathematical manipulation is required in the quantitative area of security analysis, computers can be and are now being used for these calculations, leaving human security analysts more time for the difficult qualitative judgments. This teamwork should speed up this phase of the process and also provide better information to the decision makers.

In the portfolio selection phase of the investment process, the Markowitz model, which is tested by this study, can be used to make

decisions. It is not yet in operational use by any institutional investor, however. A theoretical proof that the method does work has been provided by Markowitz [9].

The last phase, portfolio analysis, requires calculation of the portfolio return at a given time. Computers can be and are applied to this task.

The role of the computer is still in a state of flux; it obviously can be used to perform the more routine functions, and when so employed will provide more up to date information to the decision makers. Since the timing of investment is frequently of critical importance the availability of information sooner than it is presently obtained might result in purchases at lower prices and later sales at higher prices with resultant higher returns. This improved performance is likely to more than cover the expenses of computer usage within the investment process.

Summary

Investment management is a specialized type of decision making process which endeavors to allocate available investment funds among those few investment securities which, at a given time, appear to offer the highest probability of achieving the investor's objectives.

The investment process is an unending cycle which includes the steps of: forecasting the future, analysis of investment requirements, formation of investment policy, search for relevant investment alternatives, security analysis, portfolio selection, and portfolio analysis. Computers could be used for each of these steps but so far they have been applied only to security analysis and portfolio analysis functions.

Financial institutions have been increasing in economic importance in the last few decades and their increasing workload is likely to encourage them to make more extensive use of electronic computers, first for routine data processing applications, and then in the more sophisticated applications such as security analysis and portfolio selection.

A model for use in portfolio selection decision making is presented in Chapter Four and tested in Chapter Five.

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CHAPTER 3

COMPUTER ASSISTED DECISION MAKING

Introduction

This chapter contains introductory information about the use of decision models and computers in decision making and about their characteristics and limitations, both in general, and in investment management.

Despite the great apparent diversity of problems faced by businessmen there is rather wide applicability and usefulness for computer implemented mathematical models because of the generality of the decision making process itself.

The interdisciplinary approach which computers have made practical was first applied to military problems during World War II. After the war operations researchers turned to business problems and one technique, linear programming, proved to be very useful during the decade of the 1950's in many business situations.

Perspective on this systems approach to business problem solving is provided by this chapter.

The Decision Process

In spite of the great diversity of computer applications the methods of attacking problems with computers show considerable unity because of the decision process itself. The decision process consists of: the analytical stage, the prediction stage, the choice stage, and the control stage.

The analytical stage consists of several steps which are concerned with identifying the problem and clarifying its boundaries. The decision maker must first search his environment for problems in need of solution, identify the most important ones, and arrange them in the order of their importance so the most important ones can be analyzed first. The boundaries of the particular problem situation must be defined and clarified so further analysis can proceed. The goals pertinent to this problem must be identified and clarified so a new search procedure can be implemented, if necessary. Once the problem area is identified and goals are clarified, the decision maker needs to search for feasible alternative solutions to the problem.

The prediction stage consists of several steps which are concerned with the consequences of all of the alternatives. In order to evaluate the alternatives, the decision maker must first choose an appropriate measure of effectiveness which is relevant to his goals. Then he can proceed to estimate the probable outcomes of all of the most feasible alternative solutions to the problem, taking into consideration the various strategies available to him and to his competitors, and utilizing the best information which is available concerning the probability of occur-

rence of each alternative and its related payoff.

In the choice stage, the decision maker must put the particular problem into its overall broad context in terms of the firm's goals and means, and select the optimal alternative feasible solution to the problem. To do this he needs to select first an appropriate decision rule considering not only ends and means but also the quality and extent of the information which is available. Then he must analyze the outcomes and select the best one which is available.

The control stage consists of several steps concerned with the implementation and evaluation of the decision to select one of the alternatives. At the time the chosen alternative is implemented, the decision maker sets up a feedback control system which periodically reports on the status of the implemented alternative. With this information, the decision maker can evaluate his decision to see if the predicted outcome did actually occur and can ascertain the reasons for any deviation from the expected results. He can also take corrective action, based on this information, if that should be necessary.

Where there is agreement concerning the goals which are desired as end results of the decision process and the optimal combination of available means, the decision process becomes one of computation. Since both the ends and the means are explicitly defined and bounded the outcome is merely the logical result of the method employed to achieve the goal [23, p. 198]. If this is done by means of a standard operating procedure or through an iterative procedure we can refer to it as a programmed decision situation. However if there is disagreement concerning the particular means to be used to achieve the desired results then the decision situation is a non-programmed one [22, p. 59], and computers may or may not be useful. For decisions of this type a heuristic proce-

dure based on the decision maker's judgment is needed and in some cases computers can be programmed to handle these situations while in others they cannot.

Computers can be used in the decision process to aid human decision makers in searching their environment for problems and feasible alternatives to these problems. They can be used to generate information to validate models, to estimate probable outcomes of alternative courses of action, and to control the implementation of decisions by providing automatic feedback concerning exception conditions.

Models and Their Structure

Models of problem situations are usually helpful to decision makers in arriving at proper decisions. Any model is merely a representation of reality which attempts to explain the behavior of some aspect of it [18, p. 115]. Models, to be useful, must be simplifications of actual reality. Some amount of simplification is both necessary and desirable but oversimplification may destroy the predictive capability of the model [9, p. 33]. It is frequently unnecessary for the model to be completely accurate since some amount of error in the decision process is usually tolerable; therefore, the type of model which should be used in a particular situation depends on the purpose of the decision, and the degree of accuracy required of the model depends upon the degree of accuracy which is needed in the results [8, p. 12].

Models may be used for four different and distinct functions: organizing, heuristic, predictive, or mensurative, depending on the particular problem situation which is to be attacked with the aid of the model. The model performs an organizing function if it helps the decision maker to classify and relate disjointed data so as to convey information and reveal relationships which were not previously perceived. It performs an heuristic function if it helps to explain and predict the results of these relationships so as to lead to the identification of pertinent variables within the situation or to the discovery of new facts or methods of operation. It performs a predictive function if it helps to predict the results of these interrelationships and if it is possible to verify also this predictive capability; and it performs a mensurative function if it

is a model of clearly understood relationships so that data obtained with its help can be used as measures [21, pp. 79-80].

Models can also be classified, according to their major characteristics, into three basic types: iconic, analog, or symbolic. An iconic model, such as a scale model of an aircraft design, physically resembles the real world phenomenon which it represents. Models of this type are difficult to manipulate and may introduce unwanted variables into the decision process because of the very process of abstraction necessary to their creation, hence they usually have a rather low degree of predictive power and usually must be supported by other techniques. Analog models, such as the hydraulic model of the circular flow of funds in the economy, make use of one property to represent some other property which is relevant to the decision process. Such models are frequently very useful with analog computers.

Symbolic models, such as the Markowitz portfolio selection model which is the subject of this study, are composed entirely of abstract mathematical symbols which represent the real world situation of interest to the decision maker. Since symbolic models use mathematical symbols they are often called mathematical models. They are the most widely used and versatile decision models and are most useful to decision makers when used in conjunction with modern and powerful digital electronic computers since such computers can be used to solve any problem by computation after it has first been formulated in the form of a mathematical model [2, p. 109].

A mathematical model may be either descriptive or predictive depending upon whether or not it has any demonstrated capacity to predict. Even if only originally descriptive, a model may become predictive after transformation of some of the variables according to the established laws of

mathematics. This manipulative facility of mathematical models can be used to transform an organizing model into an heuristic one, and thence into a predictive one, simply by the use of the computer to perform mathematical manipulation, and quite apart from any intrinsic heuristic value which may already exist in the model as a result of the creative genius of the model builder. Whatever the nature of the phenomenon which is being studied and however complex it may be, the various components of the problem situation do bear some relationship to each other, and once the model builder is successful in formulating these relationships abstractly and precisely, he can apply the full machinery and power of mathematical analysis to produce, sometimes wondrous, results which may be far beyond his wildest expectations [14, p. 8].

Before the advent of computers, business decisions were made by human decision makers who used their best judgment to arrive at decisions. As time went by and similar problems recurred, the human decision makers developed methods (programs) for arriving at decisions based upon their accumulated experience. These were, in fact, models of the particular decision making process but they were rarely, if ever, written down or even made explicit in the minds of the decision makers until after World War II. The concurrent development of research into the decision making process and the improvement of computers has now made it possible for man to transfer some of his more routine decision making to the machine. Some decision models have been programmed for computers and can be used now, while more complex models must wait for further research results.

The essential characteristics of a model of a business problem situation are that at least one input variable must be subject to control, the relationships among and between the relevant variables must be specified, and the output variable must be an index or measure of value

of alternative solutions to the decision maker. The essential structural ingredients of computer models are, therefore, the structural equations, the variables, and the method of solution.

The structural equations of a mathematical model are of four types: definitional, technological, behavioral, and institutional. They show the basic structure of the phenomenon which is being modeled. Definitional equations describe an exact interrelationship between two or more variables. Technological equations describe the results of interactions of the variables within an essentially technological or physical process, such as the production function. Behavioral equations describe the behavior of human beings within the system being modeled and are also statements of functional relationships rather than identities. It is sometimes further possible to differentiate the behavioral equations on the basis of whether or not the behavior is random, and, if it is, then it can be referred to as stochastic behavior in contrast to deterministic behavior which is usually much more easily and accurately predicted. Stochastic behavior can frequently be predicted with tolerable accuracy as the resultant of probabilistic events, if information concerning the determining events and their probability distributions are known. Institutional equations describe the environmental constraints within which the decision maker must operate. These constraints may be either externally imposed, such as by law, or they may be internally imposed restrictions, such as those management policies which require diversification. For investment decision making problems the behavioral and institutional equations are likely to be most important.

The variables of the model which are included in these structural equations may be of two major types: endogenous or exogenous. Endogenous variables are those which are explained by the model itself, they deter-

mine other variables in the model and are, in turn, determined by other variables; their values are obtained by the solution of the simultaneous equations which comprise the model. The values of the exogenous variables are not determined by the model but are taken as given in the solution of the simultaneous equations which comprise the model, hence they are outside the scope of the model as far as explanation is concerned but they are necessary in the determination of at least one of the endogenous variables. These exogenous variables are not under the control of the decision maker whereas the endogenous variables may be.

The method used in the solution of most symbolic models is some mathematical technique which is chosen on the basis of its efficacy and practicality [2, p. 117]. The method may be analytic and make use of higher mathematics such as the calculus or it may be simply numerical if the structure of the model permits. If computers are to be used, however, the actual method must be numerical, but analytic methods can be performed on the computer by numerical means even though it would not be feasible for humans to do likewise. The great speed of the computer makes this possible and is comparable to the solution of a problem by means of either algebra or arithmetic; the human will usually prefer algebra because it is faster for him, the computer prefers arithmetic because it can do algebra and calculus this way and still arrive at the result faster than the human. Some models may be solved by simulation methods whereby the computer produces many sets of output results based on information concerning the probabilities of occurrence of the phenomena under investigation.

The significant criterion of model building success is its usefulness in providing a pattern for decision making. A simple and coherent model is not only easier to manipulate but may be more convincing to busy

executives who may have to implement the decisions which have been reached with the aid of the model [20, p. 35]. One of the major advantages of computer models is that some of the variables can be slightly changed in the process of sensitivity analysis so the decision maker can ascertain the effect of such changes on the final result of the model. Sensitivity analysis capability enhances the usefulness of models and may also be helpful in the construction of models.

The Model Building Process

The process of model building is really one of formalizing and making explicit the implicit and perhaps even unstated traditional models previously used by decision makers. It follows rather closely the decision process, and can be thought of as consisting of several stages: the formulation, construction, solution, testing, control, and use stages [10, p. 18].

In the formulation stage the model builder first establishes the need for the model. The area of analysis must be carefully defined so that the construction stage can begin. The construction stage is perhaps the most important for it is here that the model builder must identify the controllable and non-controllable elements which may have an effect on the desired results, ascertain which of these are actually the crucial ones, then symbolize and relate these in the form of equations so that a workable model results. The model builder is aided in this endeavor by analogies, implicit theories, rules of thumb, the analysis of historical data, and experimentation. Any or all of these sources may help him establish the relationships of the model [8, p. 47].

In the solution stage a decision rule which is related to the objective which the model builder seeks must be chosen and applied with an appropriate method of solution in order to discover if, in fact, the model will give some workable output information. The value of the solution depends on how adequately the model represents reality and the adequacy of the solution depends on the adequacy of the model. No model can be more accurate than its underlying assumptions, and the more complex the

model the greater the risk of error because the effect of any single assumption is less easily discernible in the result [16, p. 70]. The model must then be tested to determine its reliability and validity, and to discover if it is biased, and, if so, to what extent. The predictive power of the model can be tested by comparing its predictions based on old information with events which have actually occurred. If the model appears to be valid, useful experiments can be performed upon it in the control stage, to insure that the values of the parameters have not changed and to set up a procedure for detecting such changes if they should occur.

The usefulness of mathematical models as aids to decision making depends upon whether or not they are administratively practical. They will tend to be practical if they include all or most of the important variables in the problem area under analysis, if they characterize the problem accurately enough to improve upon the previous method or methods of analysis, and if they yield a solution which is easily interpreted and justified in terms of the underlying assumptions used [13, p. 300]. The really telling arguments in favor of using decision models are that physical experimentation is not possible and the model is faster, less expensive, and/or more accurate than any other methods for solution of the particular problem at hand.

The research reported in Chapter Five of this study provides a test of the power, reliability, validity, and practicality of the Markowitz portfolio selection model.

Important Limitations of Models

The major limitations of models are of a structural, measurement, or implementation nature. The structural problems may relate to variables which have either been omitted, or are improperly included, or are simply unknown. The structural relationships involved in the equation may be improper, actually unknown, or too complex for formal mathematical statement. The constraints which were used in the formulation of the model may have changed or they might have been omitted, or perhaps improper ones were used in the construction of the model. The model may have been correctly built but the method of solution may have been improperly used, or an altogether improper technique may have been specified.

The measurement problems may arise as the result of improper scaling, or from improper measurement techniques, or from inaccurate measurement. An improper scale may result in measurements which cannot be used for the intended purpose because they are not sensitive enough to record significant changes in the important variables or because they are oversensitive and produce too many data. Improper measurement techniques, even if used with proper scales, will not provide the data which the model builder had expected to be able to use. More frequently the measurement problems arise from inaccurate measurements which are the result either of errors of omission or observation [7, pp. 242-243]. Measurements may be accurate but may not have been taken at the appropriate time, or may not have been taken on the appropriate variable. The majority of the measurement difficulties can be expected to be the result of observational errors which may be due to the use of faulty equipment or which result

from the use of the proper equipment under adverse environmental conditions, or which simply are the result of the inability of human beings to accurately read and record the required data.

Implementation problems usually result from either the attitudes of the model builders or those of the model users, or both. The model builders may have oversimplified the problem in order to construct the model or they may have oversold management on the usefulness of the model which they have created so that users expect more than the model can deliver. The users may feel that the model attacks their secure position within the organization or they may just be adverse to the use of any mathematical technique. Future implementation problems will probably include communications difficulties which arise between model builders (programmers) and users who are not part of the same organization.

Computers and Their Limitations

The modern electronic digital computer is a machine which can read many items of data, store them, recall them for later use, manipulate them, and provide the resulting information in a form which can be read and utilized by the human brain. It can continually perform a series of repetitive operations without either getting bored or tired, while humans performing similar operations are likely to become fatigued, at least [1, p. 60].

The unique feature of the present-day computers which sets them apart from earlier machines which had been used to aid human decision makers who needed to perform some numerical calculations is their capability of accepting and following an internally stored program which tells the machine what operations to perform, when and where to perform them, and what to do when it has finished performing them.

Some of the earlier machines were, in fact, only one piece of machinery, but most of the present computers are actually composed of several different units and might more appropriately be referred to as electronic computer systems. Separate units perform the essential functions of input, working memory, auxiliary memory, arithmetic and logic operations, and output, although frequently some of these functions, such as input and output, are combined in one physical unit while others, such as auxiliary memory, are contained in many units (tape drives).

It has been traditional to consider computer applications as falling into one or the other of two major categories: data processing or scientific computation; but the trend now is toward so-called general purpose

computers which are capable of doing both types of operations. The typical data processing operation requires large amounts of input and output but only small amounts of computation, while the typical scientific operation is the opposite.

The factors which should determine whether or not a particular application will be processed by computer include the following: whether or not the method of solution is known, the frequency of occurrence of the problem, the amount of work which is required in order to reach the solution, and the urgency with which the required processing must be accomplished.

When the method of solution is known it is called an algorithm. Algorithms which have been translated into computer machine language are the programs which this study evaluates. The algorithm may be an iterative one in which the solution process proceeds in step by step fashion until it reaches a point where it cannot improve upon the solution value after performing another step.

The computer program must anticipate all questions which might arise during the processing of the problem since it must instruct the computer explicitly, and in great detail, just what to do and how to do it [17, p. 97]. Programs are usually called software to distinguish them from the machine (hardware) with which they are associated.

A major barrier to the more widespread use of computers has been the difficulty of communicating with the machine since computers can only operate on the basis of instructions which are expressed in the binary mathematical language of the machine, hence programming is the key to optimum man-machine cooperation in problem solving. Fortunately special languages have now been developed to facilitate this process. The programmer typically now writes the program in one of these languages and feeds

it to another program (a compiler) which automatically translates it to machine language.

The most commonly used special programming languages in the United States are FORTRAN (a mathematical language) which first became available in 1956 and COBOL (a commercial language) which was created in 1959 at the request of the U. S. government. FORTRAN is the nearest thing to a universal computer language and is available for 80% of U. S. and 44% of non U. S. computer models [4, pp. 1-16 and 22-23].

However, many programs now in use were not written in either FORTRAN or COBOL, and while they may be working satisfactorily now, they must be rewritten if the decision maker changes to another model of computer. The program will be rewritten, in all likelihood, by a programmer other than the one who wrote the original program, thereby exposing the decision maker to all the errors which are inherent in the programming process.

The unusually great speed of computers as compared to human data processing means that they are capable of making many more errors if something is wrong with the software which is employed for a certain application. Human data processors sometimes err because they are tired, bored, or inattentive. Computers are not susceptible to these maladies, however, but a mistake in a program either through omission or commission on the part of the programmer, may result in thousands of errors occurring in only a few seconds.

The type of error which probably causes the most trouble is the unanticipated error which was not foreseen by the programmer when he wrote the program [15, p. 210]. In addition to these errors of omission there are many types of errors of commission which may hamper the effective use of computers including clerical errors in the coding of the program into a machine readable format and structural errors in the program itself.

Errors in coding are probably the most frequent and include errors made by the programmer in writing down the various instructions as well as errors made by key punch operators when punching these instructions into the IBM cards which are used, in most installations, for original computer input.

Experienced programmers make an average of one error for every thirty instructions they write [5, p. 30]. Although experienced key punch operators sometimes make errors when punching these program instructions, these errors usually are located and corrected by key verifying the cards against the original source documents but this, of course, doubles the amount of time required for punching. An even more important problem arises in the keypunching of large amounts of input data; on one large project it was discovered that 40% of the input data had been incorrectly transcribed [11, pp. 169-71].

Although relatively less frequent, program errors of commission, such as errors in program flow, scaling, or file design, are much more serious to the program user since they are usually unseen but significant factors affecting the quality of the output of the program [19, pp. 143-145]. Errors in the program flow may result in improper calculations or operations; scaling errors may result in answers which either lack the required degree of precision or exceed it; while errors in file design may result in the recording of data which the decision maker does not need, or cause truncation of some data which are needed.

These kinds of errors can usually be discovered after many computer runs and most programmers attempt to find and correct all of them during the debugging phase of computer program creation, so decision makers need only concern themselves with input errors most of the time.

Still another type of error, which has now been virtually reduced

to the irreducible minimum, is that of machine malfunction. Although the present computers are much more reliable than the first generation machines, parts do sometimes wear out and cause malfunctions, most commonly with the peripheral equipment or external memory devices attached to the computer which may cause the dropping of a bit from a character code, but most machines in use today have built-in automatic detection routines for finding and correcting such errors.

An error in data transmission from one machine to another, which was a frequent source of trouble, is now almost non-existent since most computers have automatic routines to accomplish this function so programmers need not be concerned with this task, and transmission over longer distances can now be handled with equipment (using telephone lines) which has an error rate in transmission of less than one in every ten million characters transmitted [12, p. 70]. This equipment also has built-in automatic error detection and correction routines.

Investment Decisions and Computers

Investment decision making is essentially an allocation problem [3, p. 38] in which the decision maker must choose from among various investment alternatives those few alternatives which are most likely to achieve the desired results. There is general agreement on the set of investment jobs to be accomplished, insufficient resources are available to do all of them, and there is not enough time to allow an exhaustive and comprehensive search for the optimal combination. Information concerning outcomes is uncertain, and some ways of combining securities into portfolios are likely, in retrospect, to be better than others [6, p. 219].

The problem is to select that set of securities which, on the basis of available information, appears to provide the highest probability of achieving the goal over the time horizon involved. This problem can be solved with the aid of a digital computer and the Markowitz model if the human decision maker can provide the appropriate input data. The model requires the computer to perform the same computations that a human decision maker would make but it can do so much faster while at the same time considering many more securities for possible inclusion in the portfolio.

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CHAPTER 4

THE PORTFOLIO SELECTION MODEL

Introduction

This chapter describes a model of the ultimate phase of the investment management process, which has been defined as: "the art of combining in a portfolio of securities those investments which from time to time appear most likely to meet a proper balance of the various, changing, and conflicting requirements of the investor" [1, p. v.].

This definition gives primary emphasis to the ex ante selection of several securities at a time to make up a portfolio and points out the dynamic nature of the problem in the real world. The model presented in this chapter is only a first step in what will be, no doubt, a long trip toward a dynamic theory of portfolio selection because it is concerned only with portfolio selection at a given point in time. Before attacking the complex dynamic problem it is wiser to consider a static case whose solution might then point out the proper path to be followed in attempting to solve the dynamic case.

Portfolio selection depends upon security analysis for the proper input data and this, of course, is another problem area deserving of study, but, at present, it is outside the scope of this research project. A mechanical security analysis procedure will be used later to test the model presented here.

There is general agreement among writers on the subject of security analysis that its essential function is to forecast the return to be expected from a security and to estimate the degree of risk associated

with this return [11, p. 717; 33, p. 429].

Many different types of securities exist, such as bonds, preferred stocks, and common stocks, and they number well up in the thousands. Given some guidelines based upon the investor's goals and resources, security analysis can screen out large numbers of securities which would not be suitable for inclusion within the portfolio and concentrate on only a few hundred candidates which would be likely to qualify for inclusion in the portfolio.

The portfolio selection process itself can then begin with only a few hundred (or even less) securities about which the security analysis procedure has provided some information and arrive at a portfolio of appropriate size and composition.

This chapter provides a survey and synthesis of the literature on the theory of portfolio selection.

The Portfolio Selection Problem

The portfolio selection decision problem is to attempt to maximize return, both periodic income and capital gains, on assets employed (which are frequently restricted to securities only) while simultaneously minimizing the exposure to risk, or holding it within specified tolerable limits, over some period of time (the investment horizon).

The decision maker must select, from an almost infinite variety of available securities, those few which have the highest (to him) joint probability of achieving the desired objectives over the investment horizon. Every investor is assumed to prefer more return rather than less, and less risk rather than more; in other words, he is assumed to be a risk averting return maximizer. Return is maximized by that portfolio which provides the highest possible expected return for any given level of risk (uncertainty of achieving the desired return).

The investor must forecast the future return and degree of risk on the basis of incomplete presently available information and make the best possible portfolio selection decision that he can at a particular time, under time pressure, and within the constraints imposed by law, tradition, and policy.

Periodically thereafter he must (or should) review the portfolio and make any necessary adjustments which are warranted in view of changing conditions in the present and changed expectations about the future. Any such adjustments need to consider the costs involved in effecting changes in the portfolio and the expected benefits to be derived therefrom.

The Markowitz model allows man-computer cooperation in the selection of portfolios in the way in which the rational investor himself would do it, if he could. The computer merely performs the mechanical calculation parts of the investment process, allowing consideration of many more alternatives than an unaided human could consider by himself. The computer follows a mathematical procedure which chooses a set of efficient ex ante portfolios from which the investor can select the "optimal" portfolio for his particular situation. The mathematical procedure is patterned after a recommended financial decision making procedure of choosing the most important goal for maximization and formulating all subsidiary goals as constraints [3, pp. 1-15].

Expected Holding Period Return

The holding period return on common stock investment is composed of dividend income received periodically (usually quarterly) while the investor holds the security plus the capital gain (or loss) which occurs when the investor ceases to hold the security. These two types of return are analogous to the periodic interest payments (usually semi-annual) received by bondholders and the principal amount which they receive at maturity. Portfolio holding period return is the weighted sum of the returns of the component securities where the weights represent the proportion of the total investible funds invested in each security.

During the post World War II period the trend of stock prices generally has been upward so most long term common stock investors can reasonably expect a capital gain, which can also be reasonably expected to exceed the dividend income in magnitude. Since there is considerable agreement concerning the regularity and predictability of dividends, and because the U. S. tax system favors capital gains, the long term investor can logically be expected to obtain most of his return from capital gains.

Mathematically, holding period return on common stocks over some investment horizon can be written as: $HPR = \frac{DI + CG}{CB}$

Where HPR = Holding Period Return, expressed as a rate or percentage of original investment,

DI = Dividend Income received during the holding period,

CG = Capital Gain = Ending Price - Original Cost Basis, and

CB = Cost Basis of original investment [18, p. 12].

This formula can be used for both ex ante and ex post analyses. The ex ante holding period return analysis would require estimates of the dividend income to be received during the period and the anticipated capital gain. Ex post analyses need merely to substitute actual dividend income and realized capital gain for the estimates. Since portfolio selection is an ex ante decision problem, it is expected holding period return which is relevant for decision making.

For the purposes of this research study each security in a given portfolio will have the same holding period and each portfolio analyzed will have the same holding period (ten years).

Risk and Diversification

Risk is defined as the uncertainty of achieving the investment objective and it is usually measured by considering the probability of loss of principal and/or income [24, p. 7]. Therefore the investor's capacity for risk taking depends on his ability to risk loss of principal or income. This is affected by the size of his principal, the magnitude of his other sources of income, and the time remaining for achievement of his objectives. A loss of dividend income is more likely to result from actions outside the control of the investor (as, for example, if the board of directors of one of his companies decides to omit the dividend or reduce it) but realized capital losses, except for companies which go bankrupt, can only result from the deliberate action of the investor to sell his securities.

If the institutional investor has a ten-year investment horizon (holding period), only the prices of portfolio securities ten years hence are relevant to the problem of risk measurement. It is, therefore, improper to consider risk except in terms of some time period. A recent study of all New York Stock Exchange listed stocks for the period 1926-1965 (820 overlapping one-year time periods) indicates that losses occurred only 8.8% of the time, and there was no ten-year period within which the investor earned less than 11% per annum compounded annually [10, p. 3]. These data would seem to indicate that many investors are overly concerned about potential losses and are not taking as much risk as they are capable of safely assuming.

Diversification has been the primary policy for coping with risk.

If the estimate of expected return were correct then diversification would not be necessary except when required by law, tradition, or policy. Concentration of investment funds might result in maximum return but, at least in the present state of human knowledge, it is also likely to maximize risk during the holding period.

A good summary of the heuristic diversification policies which have been developed by investors can be found in Hayes' textbook [12, pp. 447-455] which discusses the principles of risk diversification with respect to several aspects of risk, among which are: time risk, cyclical risk, financial risk, interest rate risk, purchasing power risk, market risk, political risk and foreign exchange risk.

The time risk is the secular risk involved in investments in declining industries and in investments in other industries at what, in retrospect, proves to be an inopportune time; cyclical risk is the result of the differential effects of business cycles on different industries; financial risk is probably the most important since it refers to the ability of the issuer of the securities to make periodic payments and it is these periodic payments which make most securities desirable investments; interest rate risk refers to changes in asset values which are caused by changes in the level and term structure of interest rates and have their principal impact on bonds and other fixed dollar investment media; purchasing power risk is the uncertainty surrounding the purchasing power of the periodic income and future capital gains when received; market risk refers to the uncertainty arising from the psychological swings in investor sentiment which cause capricious and sometimes wide price changes of certain types of stocks (such as international oils, life insurance companies, or airlines); while political risk and foreign exchange risk refer to losses which might result from expropriation,

devaluation, or fluctuations in foreign exchange rates.

The recommended policy for U. S. investors wishing to minimize the political risk and foreign exchange risk is to invest only in domestic firms. The cyclical, time, and financial risks can be minimized by diversification among different industries and different companies within industries while the effects of interest rate and purchasing power risks can be minimized by investment in common stocks [12, pp. 447-455].

Another aspect of risk, valuation risk, is not usually referred to directly in the literature but is really the major reason for diversification. The valuation risk [12, pp. 449-450] refers to errors in the security analysis phase of the investment management process which is directed primarily at evaluating financial risk. We must expect errors in security analysis and these errors will obviously affect the portfolio selection phase but they cannot be entirely avoided and they will not necessarily cancel out [20]. The real purpose of diversification, then, is to reduce the impact of these mistakes but diversification will also dilute the effects of outstanding performance of individual stocks, with the result that as diversification increases, the probability increases that portfolio returns will resemble the average [12, p. 447].

Still another type of risk, liquidity risk, can be identified (and frequently is cited by professional portfolio managers as an important type of risk). It refers to the losses which may result when portfolio securities must be liquidated to make payments from the portfolio corpus to its beneficiaries. This, of course, is a dynamic problem of considerable importance to those institutional investors who are required to make occasional payments from the portfolio which are larger than new funds inflows. Many institutional investors protect their portfolios from this type of risk by always keeping some portion of their assets

invested in cash or in Treasury Bills which can easily and quickly be converted into cash on short notice at predictable prices.

Portfolio Selection Theory

Harry M. Markowitz, in a 1952 Journal of Finance article entitled: "Portfolio Selection" proposed a normative theory which explained efficient diversification by risk averting investors [19, pp. 77-91]. This theory was later expanded by Markowitz in his book [18], by Tobin [31] who used it to formulate a positive theory, and by Sharpe [28] who devised a more efficient computational procedure.

The Markowitz theory treats holding period return (as defined previously) of any individual security as a random variable whose value is expected to vary in a random manner within limits specified by security analysis. Expected return is then considered to be the mathematical expectation (mean) of the subjective probability distribution of possible returns. Risk is measured by the statistical variance of expected returns since the normal fluctuations which are to be expected around the mean return value are likely to be symmetric.

Figure 1 graphically illustrates security returns as random variables. In the diagrams, expected returns for three securities are plotted along the horizontal axis while the relative probability that the return will actually have the expected value is indicated by the height of the curve and plotted along the vertical axis. The degree of risk is represented by the variance of these returns, and the size of the variance is indicated by the shaded boxes. These shaded boxes forcefully illustrate the nonlinear relationship of changes in the degree of risk.

A portfolio is defined to consist of one or more securities (usually several) with a definite percentage of the total investible funds being

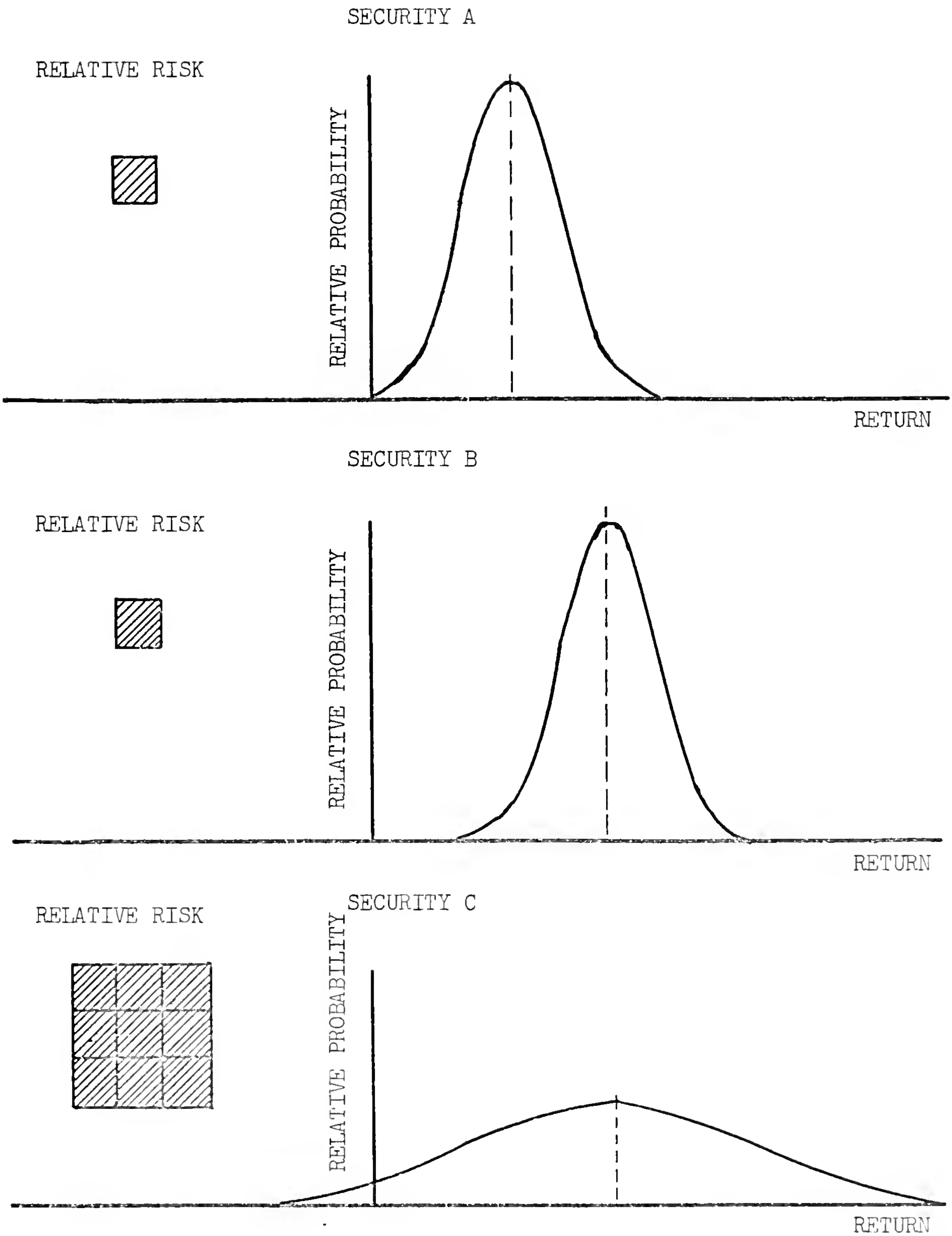

FIGURE 1

SECURITY RETURNS AS RANDOM VARIABLES

invested in each selected security. Portfolio return is the sum of the expected returns from each security weighted by the percentage of the total invested. Portfolio risk is the variance of the portfolio as a whole. It depends upon the variance of each component security and the covariance of each security with each and every other security in the portfolio, weighted according to the amount invested in each security.

The covariance is a key concept in the theory of portfolio selection. It is defined as the product of the variance (or standard deviation) of each of the securities and their correlation coefficient. It measures that part of the total risk which depends on the degree of price correlation between two securities. Two securities which always move up and down in price together will have a correlation coefficient of +1 while two securities which always move in opposite directions at the same rate will have a correlation coefficient of -1. Whenever there is no statistical association between the prices of two securities the correlation coefficient will be zero. The lower the correlation (including negative correlation which is lower than positive correlation of small magnitude) between two securities the greater the diversification of risk. Lower correlation is advantageous, of course, only when other factors (return) are equal.

Since portfolio variance includes the covariances between each pair of securities included within the portfolio as well as the variance of each of the component securities individually, the theory provides a model which maximizes expected return for a given level of risk or minimizes risk for a given level of return by providing a series of acceptable and efficient portfolios from which the investment decision maker can then choose the optimal portfolio for his objectives.

Figure 2 graphically illustrates the domain of all the possible

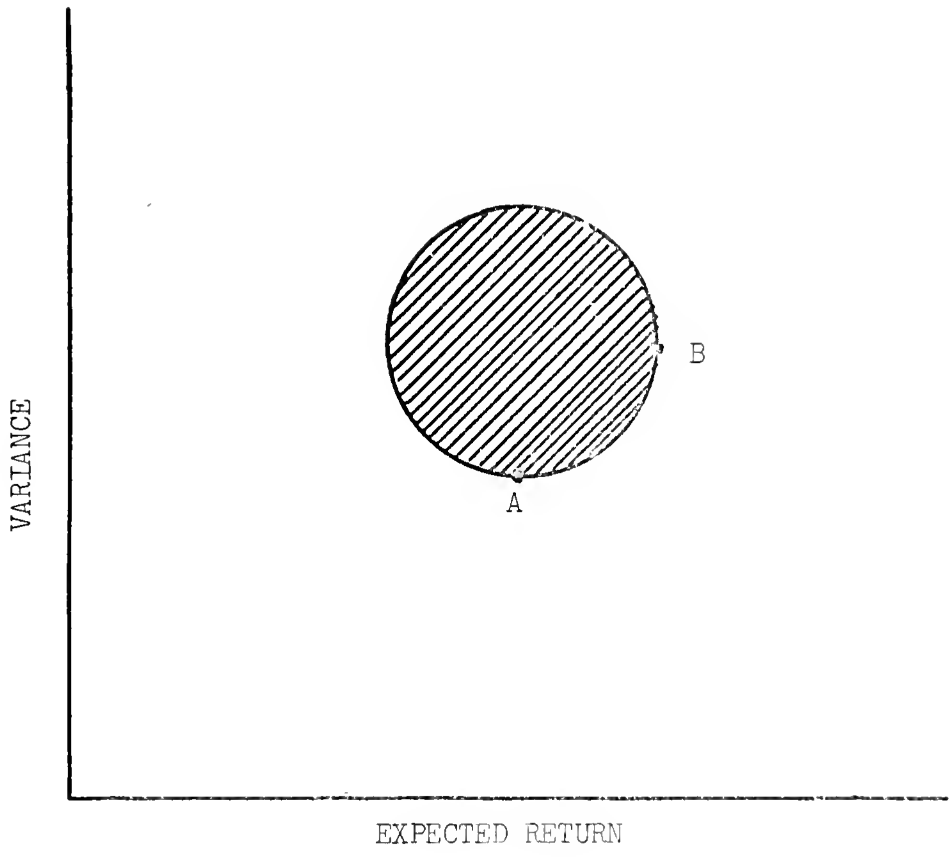

FIGURE 2

PORTFOLIOS DESCRIBED BY VARIANCE AND EXPECTED RETURN

portfolios that could be obtained from a given set of securities. Each point within this domain represents a portfolio defined in terms of its expected holding period return and variance. Expected return is plotted along the horizontal axis and variance along the vertical axis of the graph. The shaded area includes the set of acceptable portfolios.

An acceptable portfolio is defined as one which conforms to all legal, natural, and policy constraints. In the case of a mutual fund a legal portfolio would have to include at least 20 securities. Natural constraints include positive investment (no short sales) in each security and total investment in all securities not more than 100% of investible funds (no borrowing). Policy constraints might include a requirement that not more than a certain percentage (say 10%) could be invested in any one industry no matter how many firms in the industry might otherwise qualify.

An efficient portfolio is defined as an acceptable portfolio which provides the greatest possible expected return for a given level of risk or the lowest possible risk for a given level of return. An efficient portfolio might be found anywhere between and including the lowest risk and highest return portfolios. Efficient portfolios lie along the boundary (efficient frontier) of the acceptable portfolio set (between points A and B in figure 2). They are efficient because portfolios above the line possess lower return at the same level of risk [18, p. 22]. There is, actually, a continuous spectrum of efficient portfolios along the efficiency frontier, no one of which is mathematically any better than the others. Since this is the case the computer program provides a listing of all of them because the procedure it follows is to first find the maximum return portfolios; then proceed down the critical line through all the other efficient portfolios to the minimum risk portfolio.

The critical line is determined by the critical points which indicate the relationship between return and risk. A critical point occurs each time a security enters or leaves the portfolio set and each time a constraint either becomes effective or ceases to be effective in determining the composition of the portfolio. The critical line actually is a series of parabolic curves, joined at the critical points, which express the nonlinear nature of the return-risk relationship.

Figures 3 and 4 illustrate a three-security problem with only natural constraints. Figure 3 identifies the critical points of the trade-off relationships which exist among the three securities for four possible portfolio combinations. Figure 4 provides a close-up of the efficiency frontier (which in mathematical terminology is the critical line) where point 1 corresponds to point A of figure 2 and point 4 corresponds to point B of figure 2, and points 2 and 3 represent intermediate portfolios. As expected from the financial literature on the subject of risk and return, a close correlation between risk and return is evident with portfolio 4 providing the highest expected return and the highest risk while portfolio 1 has both the lowest expected return and risk.

In the direct form so far described the theory requires, as inputs, an estimate of expected return for each security plus an estimate of the variance for each security plus an estimate of the covariance for each pair of securities. For 100 securities, 100 expected returns, 100 expected variances, and 4,950 covariances are needed, for a total of 5,150 input data items. For 1,000 securities, 501,500 data items would be required and for an analysis of 2,000 securities over two million data inputs would be required. Obviously, the data preparation requirements of this direct format seriously impede its practical operation and add to its cost.

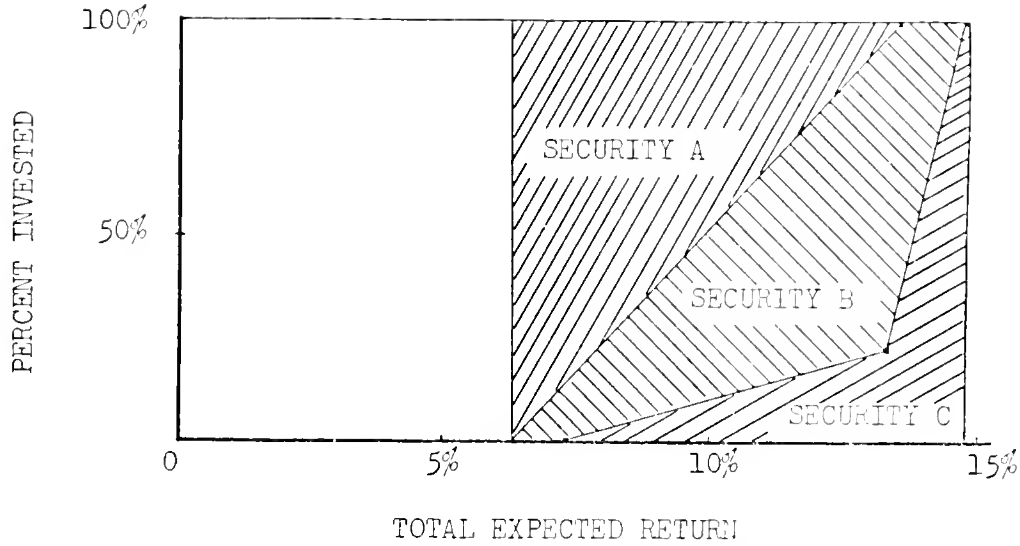

FIGURE 3

CRITICAL POINTS FOR THREE AVAILABLE SECURITIES

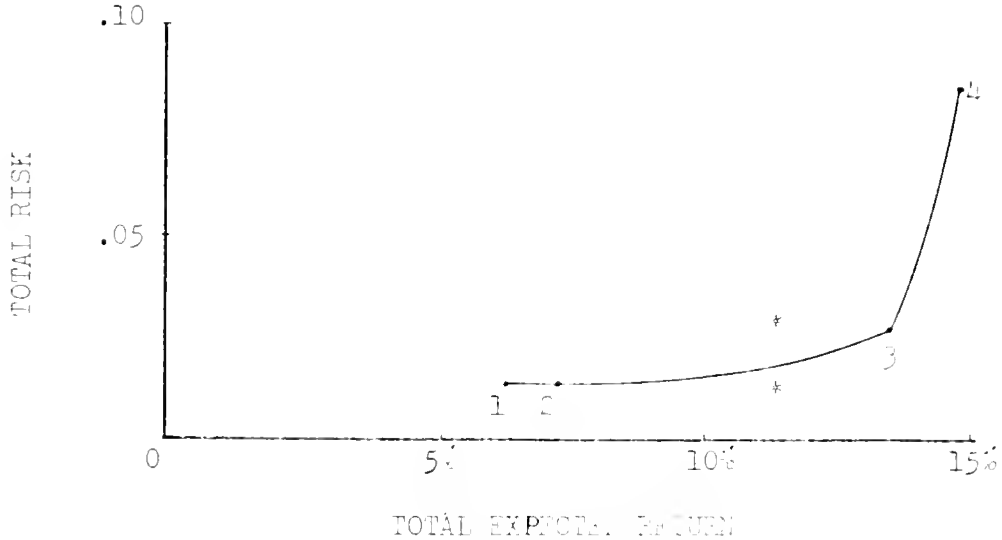

FIGURE 4

CRITICAL LINE FOR FOUR POSSIBLE PORTFOLIOS

Fortunately, there is a short-cut method for handling the problem of providing the covariance data inputs. This short-cut was proposed by Markowitz [18, pp. 96-101] and first proved by Sharpe [26, pp. 277-293]. Later supporting evidence has been provided by Cohen and Pogue [6, pp. 166-193], King [13, pp. 139-190] and Feeney and Hester [9, pp. 110-138].

The short-cut method is called the index format. Its basic characteristic is the tying of individual security estimates to an index (such as the Dow Jones Industrial Average) so the needed covariances can be deduced by the computer program rather than be explicitly stated by the decision maker. Sharpe proved that this procedure gives the same results as the direct format while drastically reducing computation costs. It also conforms with the procedure actually followed by many investors wherein they first forecast the expected market action as indicated by some well-known index and then make individual security forecasts in relation to this market estimate.

The theory of the index tie (and its associated computer program) requires estimates of the expected return (represented by price) and variance of each security at some future date, along with estimates of the value of the index and the variance associated with this index value for the same future date. A least squares regression line (defined by its slope and intercept) is then fitted to these points. The slope represents the relationship between the index value and the expected return of the security while the intercept represents an imaginary value for expected return if the index should go to zero. This line can then be used to calculate the covariances of all securities since they are all related to the index and also it indicates how much of the expected return will result from market (movement of the index) factors as well as the

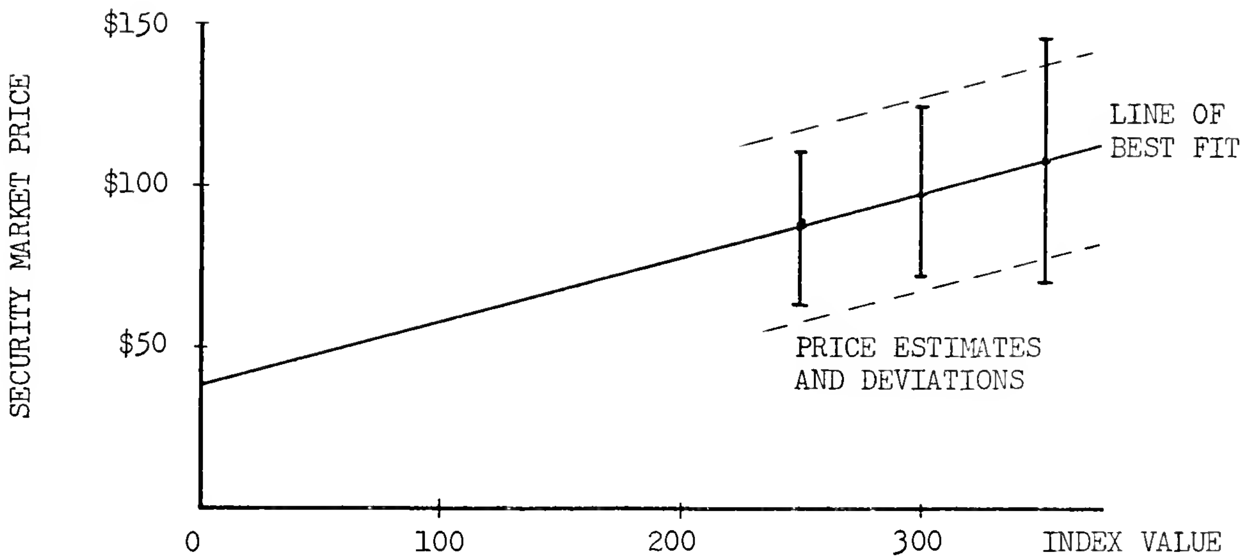

FIGURE 5

DERIVING INDEX TIE PARAMETERS

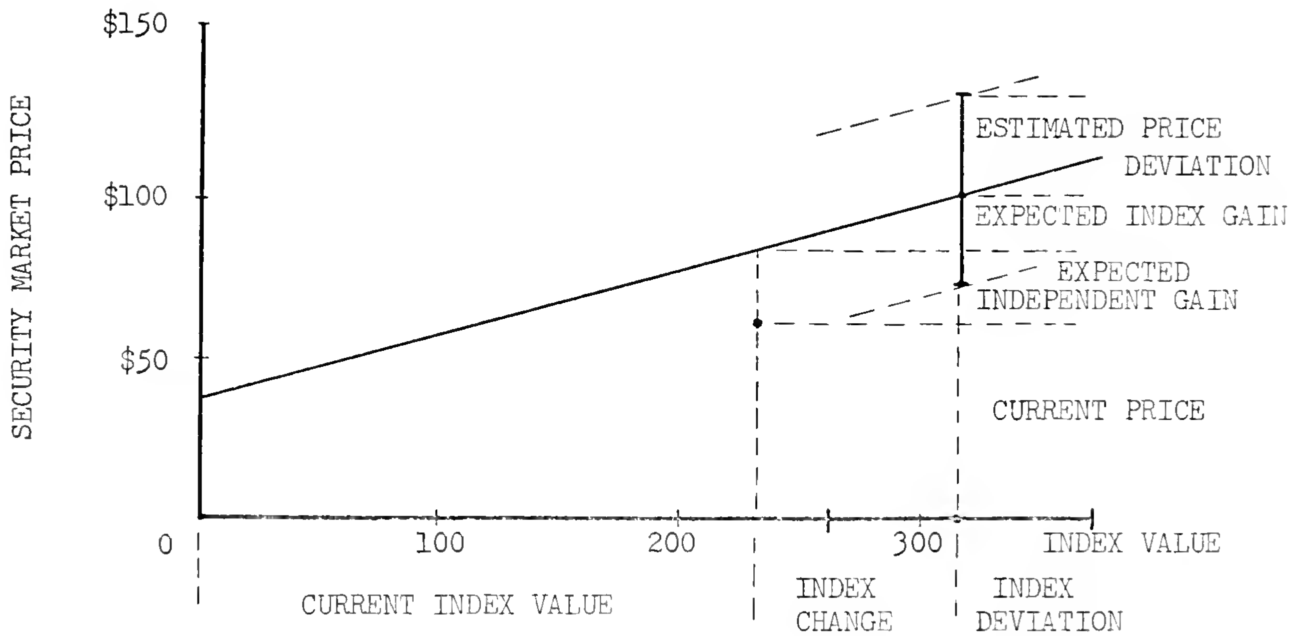

FIGURE 6

USING INDEX TIE PARAMETERS

amount which is expected to result from the effects of other factors. Figures 5 and 6 illustrate the derivation and use of the index tie parameters.

Considerable theoretical research on the Markowitz model has been carried out by Tobin [31], Sharpe [26, 27], Fama [7], Lintner [15, 16], Baumol [2], Samuelson [22, 23] and others. There is general agreement in the literature that the model is useful as a normative construct and that Markowitz should be considered the father of scientific portfolio selection.

Limitations of the Model

There is still some dispute among statisticians and decision theorists concerning the applicability of statistical theory to decision making problems when it is not possible to determine the objective probabilities which are faced by the decision maker. Decision theory generally distinguishes between risk and uncertainty, defining risk as applicable to situations in which it is possible to objectively determine the probabilities associated with particular outcomes (such as gambling or insurance) and uncertainty as applicable to situations in which this is not possible.

Portfolio selection is clearly a problem of uncertainty in the decision theory sense since no one can know what will happen in the future. Finance literature, however, has always referred to the portfolio selection problem as one involving risk and it is so considered throughout this study.

Classical statisticians reject the use of probabilities for the portfolio selection problem while Bayesian statisticians feel that something is better than nothing when a decision must be made, and investment decisions are being made every day. Game theory and Clarkson's simulation method [4] provide possible approaches for those who reject the statistical nature of the Markowitz model.

For those who accept the basic ideas of the Markowitz model its point in time approach is felt to be a limitation on its practical usefulness. Research aimed at applying the Markowitz model to inter-temporal situations has been conducted by Mossin [21], Smith [30], and Cohen and

Elton [5] and will doubtlessly be an important area of further research. It is the viewpoint of this author that the single point in time approach is a necessary precondition to inter-temporal analysis.

Still others object to the use of the mathematical expectation (mean) and related variance as parameters to describe the probability distribution. Classical statistics has used this approach for gambling problems for at least two centuries. Tobin [31] and Lintner [16] as well as Markowitz [18] have proved that if the investor is concerned only with two parameters -- return and risk -- then the mathematical expectation of return and its variance (or standard deviation) are the appropriate measures to use. Statistical theory would, furthermore, lead us to use the coefficient of variation as the appropriate risk measure since the mean returns from different securities are not likely to be of the same absolute magnitude. However, since both the standard deviation and the coefficient of variation which relates the standard deviation to the mean are derived from the variance, there can be no worthwhile dispute on this aspect of the Markowitz theory.

The strongest criticisms so far made have been directed at other aspects of the variance. Fama [7] and Samuelson [23], working independently, both attacked the problem posed by Mandelbrot [17] who discovered evidence leading to the conclusion that stock prices do not conform to a normal distribution but to a stable Pareto-Levy distribution which, unfortunately, has an infinite variance because it is asymptotic. They proved, however, that the Markowitz model could still be used even if stock prices do belong to a stable Pareto type probability distribution. An apparently very promising area for further empirical research is an investigation of the properties of a rather new probability distribution -- the Weibull -- which is enjoying increasing popularity in engineering

applications. This distribution, like the normal, is completely described by two parameters. It fits most observed data distributions and includes both the normal and the Pareto-Levy distributions as limiting cases. It is simple and easy to use, but, so far, in the financial area, it has only been applied to capital budgeting problems [14].

Another criticism, frequently voiced by portfolio managers, suggests that they refuse to use the Markowitz model for the wrong reasons. They argue that risk cannot be represented by variance since that assumes existence of a symmetric probability distribution and this clearly conflicts with reality since it is possible to achieve returns greater than 100% but impossible to lose more than 100% of the funds invested, and therefore it is the semi-variance which should be used rather than the variance to represent risk because it considers only those downward fluctuations in return which are thought to be most relevant. Those who make this criticism ignore the statistical fact that samples from any kind of probability distribution tend to be normally distributed [32, p. 360] and individual stock price data are samples. Furthermore, Markowitz proved in his book [18, pp. 188-201 and 287-297] that the semi-variance produces the same results as the variance over the most relevant part of the critical line while its computational costs are much higher for all parts of the line and its returns are lower on those parts of the critical line where its portfolios dominate those selected by using the variance along with the mean.

When all aspects of the situation are considered it appears that the mean-variance parameters are the most useful and are highly likely to produce results superior to those resulting from the use of any other combination of parameters, such as: the mean, median, or mode as a return measure along with standard deviation, semi-variance, range, expected

value of loss, expected absolute deviation, probable loss equal to or less than zero, or maximum expected loss as risk measures when the investor's utility function for wealth is nonlinear and the expected return data are either normally distributed or are symmetrically non-normally distributed [18, p. 297].

Another limitation of the Markowitz model, according to some industry critics (based on anonymous responses to a mail survey of financial institutions conducted by the author for this study), is that the mean-variance methodology does not capture all of the relevant aspects of risk. This criticism is largely irrelevant since for practical purposes we do not need a perfect model but only one which can produce better results than are obtained without it.

All aspects of risk may not even be relevant to the solution of the problem. Unless the perceived aspects of risk can affect the price of the stock and/or its dividend yield the investor cannot suffer an actual loss. If stock price fluctuations (mostly upward, over long periods of time) are so large that they overpower dividend fluctuations it is also highly likely that they will greatly exceed any transactions cost effects.

Liquidity risks are relevant if and only if the investor has a high probability of being forced to sell securities at an inopportune time. This possible loss can be hedged against simply by keeping some portion of total investible funds in cash or Treasury Bills. The portfolio selection computer program can be set to keep some set percentage of funds in cash (which will have zero risk) if the investor is and should really be concerned about liquidity risk, or it can be used to specify the appropriate percentage.

Empirical Tests of the Model

The Markowitz model has so far been subjected to relatively little empirical testing. It is likely that some financial institutions have experimented with it but they have not made their results public.

Farrar, in a Ford Foundation Award winning dissertation [8], compared Markowitz type efficient portfolios with actual mutual fund portfolios and found the funds to be very close to the efficient portfolios predicted by the computer. He also found mutual funds which claimed to be risky holding portfolios near the risky end of the efficient set while the less risky mutual funds held lower risk efficient portfolios. He concluded that the model is a relatively good predictor of actual behavior.

Sharpe provided corroborative evidence for Farrar's findings [29] and also showed that the riskier mutual funds in his sample chose portfolios with a higher variance than the less risky funds. In his dissertation [25] and elsewhere [26] Sharpe reported on empirical testing of the diagonal index model which provides very nearly the same portfolios as the full Markowitz model but at much less cost. He proved that the linear relationship between an individual stock and the stock market index is sufficient to determine the covariance between stocks.

Markowitz provided the theory and Sharpe made practical application of the model feasible but neither has published any research results relevant to investor performance based on the model. Cohen and Pogue provided corroborative evidence on the Sharpe extension of the model [6] and proved that a single index model provided better results for common stock investments than a multi-index model.

All of these previous research projects used small samples of 100 or less stocks. The research reported in the next chapter of this study utilizes a much larger (665) basic sample and provides also a test of a surrogate risk measure which, if operationally useful, would further reduce computational costs.

Implementation of the Model

The Markowitz model is a single period, point in time portfolio selection algorithm which is most appropriate for investors who follow a buy and hold investment strategy. At least three mutual funds, and many trust funds as well as some pension funds utilize this strategy. Many other institutional investors pursue a more dynamic strategy which requires periodic portfolio review and frequent transactions.

Financial institutions which have a high degree of portfolio turnover may need to reassess the costs and benefits of such transactions in view of the results presented in the following chapter. Portfolio turnover should be engaged in only when results superior to the buy and hold strategy can reasonably be expected.

If the periodic transactions are infrequent the Markowitz model can be used for sequential decision making by large institutional investors. The cost of a single computer run depends upon the number of securities analyzed, the number of corner portfolios, and the method of providing data inputs.

In the present state of the art of computing, a typical run of 300 securities for an institutional investor, using the IBM Portfolio Selection Program, would likely cost at least several hundred dollars for computer time and data preparation.

Summary

The electronic computer has made possible the practical application of a theoretical portfolio selection model first proposed in 1952 by Harry M. Markowitz. Computer programs for implementing the model have been available to IBM computer users since 1963 but so far very few financial institutions have publicly admitted any attempts to use the model.

It is likely that many institutional investors are not using the model for the wrong reasons since the model does provide maximal returns for specified risk levels or minimal risk for specified return levels subject to legal, traditional, policy and natural constraints.

Computational costs, data unavailability, and lack of managerial understanding, acceptance, and support have been the major factors impeding more widespread usage of the model. Computational costs, although still not trivial, are declining and computer-ready data are now available at reasonable cost so managerial acceptance seems to be the major impeding factor at the present time.

It is unlikely that the computer could ever replace man completely in portfolio selection decision making since the computer programs require human input information in order to arrive at efficient portfolios. The computer, however, can serve as an extension of the investment manager's brainpower by allowing him more time for consideration of important qualitative factors and by helping him to consider many more alternatives than would be possible otherwise. Future man-machine decisions can, therefore, be much better decisions in terms of realized returns on investment funds.

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CHAPTER 5

EMPIRICAL EVALUATION OF THE MODEL

Introduction

This chapter reports the results of the simulation studies performed with the Markowitz model which indicate that it was able, for the securities data base and the time periods used in this study, to select portfolios which provided statistically significantly (at the .01 level) greater returns at lower levels of risk than any other comparable selection method tested.

As mentioned in the previous chapter, very little empirical research has been published so far concerning the potential practical usefulness of the Markowitz model despite the fact that many financial and academic institutions possess the necessary computers and have access to the required programs and basic data.

This study seeks to fill this information gap by comparing the performance of computer generated portfolios with random, mutual fund, and market index portfolios in order to evaluate the efficacity of the portfolio selection model.

Hypotheses

The specific primary hypothesis which is tested by this simulation study is that an institutional investor whose objective is to maximize holding period return subject to constraints, at an acceptable level of risk, over a ten-year investment horizon, with either the equal dollar or equal share buy and hold strategy, could have selected portfolios with the Markowitz model in 1956, 1957 or 1958, with information which was available at that time, which were superior to those actually selected.

The simulation results of portfolios selected in 1956, 1957, and 1958 and held unchanged for ten years are used to evaluate the efficacy of the portfolio selection process by the only criterion which is relevant to investors: actual performance over the holding period.

The procedure followed in this test is similar to that of Friend and Vickers [5] who concluded that the Markowitz portfolio selection procedure does not provide any clues to future performance of selected securities and that mutual fund investment managers cannot provide performance better than random selection. The t test at the .01 level of significance will be used to test the null hypothesis of no difference between the computer selections and the others.

A subsidiary hypothesis which is also tested herein is that an ex ante risk index based upon Standard and Poor's stock rankings is an efficient predictor of ex post variability in portfolio returns. If this test provides support for this method of handling risk it will provide the investment community with a significant and relatively inexpensive extension of the Markowitz model.

The Data Base

The data base used in this study is the annual basic COMPUSTAT industrials service for the years 1965, 1966, and 1967. This service consists of one large magnetic tape file for each of the three years, which contains twenty years of annual financial data on nine hundred large industrial firms of interest to institutional investors.

The COMPUSTAT service is the only comprehensive computer sensible data base presently available. It was created in 1962 by Standard Statistics Company, a subsidiary of Standard and Poor's Corporation, and is available, for a fee, to any interested investor. Since it was created in 1962 and does not contain any companies which might have been bought by investors prior to 1962 which subsequently went bankrupt it might be somewhat biased. It is not possible, of course, to estimate exactly how much upward bias there might be in portfolios selected from this data base but any such bias, if present at all, is not expected to significantly affect the results of this simulation study since the institutional investors usually concentrate their investment funds in the stocks of large well-known firms which rarely go bankrupt.

Many mergers did take place over the 1946-1967 time span covered by this study and, even though an investment might have been originally made in a merged company, the simulations reported herein report the name of the surviving firm only.

All of the sixty individual data items for each firm contained in the COMPUSTAT data base were not needed for this study, of course, and only the annual dividends paid, high price for the year, low price for

the year, and closing price for the year were used. These per share data items on the tape had been adjusted for all stock splits and stock dividends. Prices on the tape were rounded to the nearest integer and dividends were carried to two decimal places on the tape. All of these data items were used as found on the tapes and their accuracy is warranted by Standard Statistics Company. These data were retrieved from COMPUSTAT with the IBM Financial Analysis Program which printed out the required information for each company. It is assummed that no unintentional biases or errors were introduced at this stage of the study.

The Samples

Since the portfolio selection program cannot consider more than 300 stocks at one time because of computer memory size limitations the original 900 company data file had to be reduced. The first screening was accomplished by printing out, for all 900 firms, the data for the period 1946-1955 to see if the files on some companies were incomplete. As expected, some data for some of the companies was not available for this period of time and a sample of 655 companies was obtained in this manner.

Ten additional firms, from industries such as railroads and public utilities, which were not included in the COMPUSTAT tape, were added to this sample because their securities were held by portfolios which were intended to be used for reference purposes. The necessary data for these firms were obtained from the standard sources such as Moody's manuals and the Standard and Poor's Stock Guide. The 665 companies, selected in this manner, constitute the basic sample used in this study, and these companies are listed in Appendix A.

The second screening was accomplished by dividing the basic 665 company sample into three groups of approximately equal size. Each of these groups was then run through the portfolio selection program which had been set to select the 100 "best" stocks of each group on the basis of ex post holding period return for the 1946-1955 period. These 300 companies constitute the reduced sample. They are listed in Appendix B.

Risk Classes

Since it was desired to test the practical applicability of the Standard and Poor's Stock Rankings as risk surrogates, each stock in the basic sample was assigned to one of eight risk classes according to its Standard and Poor's ranking at the end of 1955.

The ranking is assigned by the investment advisory service to each company whose record is sufficiently stable to qualify it for ranking. It is assigned by means of a mathematical and judgmental process which uses eight years of earnings per share and dividends paid data, adjusted for non-recurring items, as basic inputs.

It is published monthly in the Standard and Poor's Stock Guide and represents an easily obtainable and ostensibly objective rating which can reasonably be expected to be useful to investors generally and users of the Markowitz model in particular since it is generally assumed in the financial literature that earnings or dividends (or both) determine stock prices and the Standard and Poor's ranking is based on precisely this information.

At the present time, although the COMPUSTAT data base is produced by the same company, the Standard and Poor's ranking is not included on the COMPUSTAT tapes. Hence, it was necessary to obtain this information from the Standard and Poor's Stock Guide. Table 2 indicates the number of stocks from both the basic and reduced samples which are included in each risk class.

TABLE 2

RISK CLASSIFICATION OF SAMPLE STOCKS

Risk Class	Standard and Poor's Ranking	Number of Stocks Basic Sample		Number of Stocks Reduced Sample
1	A+	47		16
2	A	101		26
3	A-	111		41
4	B+	197		87
5	B	117		63
6	B-	36		20
7	C	11		11
8	All Other Rankings	45		36
		665	Total	300

Source: Standard and Poor's Corporation, Stock Guide, January 1956 [13].

Security Analysis

Since it is portfolio selection which is the object of this study and security analysis serves as the necessary input to portfolio selection, a mechanical security analysis procedure was employed in order to minimize any bias which might arise in the simulation if a subjective security analysis procedure, such as those most often used in real life, had been used.

The specific security analysis technique utilized herein is based upon the assumption that holding period performance in the performance periods (1956-1965, 1957-1966, 1958-1967) will not be significantly different, for most stocks, from that of the history input period (1946-1955).

The security analysis procedure was implemented by the IBM Portfolio Selection Program [3] which was used to select the reduced sample of 300 stocks from which the actual portfolios used in the simulation were selected. Each of the 665 stocks in the basic sample had the same opportunity to meet the selection criterion (high holding period return during the input period) and be selected by the program.

Selected Portfolios

The six computer selected portfolios, L through Q inclusive, were selected from the reduced sample. The performance of these portfolios is compared, in a later section of this chapter, to the performance of eleven reference portfolios.

These six computer selected portfolios are all, of course, efficient in the Markowitz sense (as discussed in the preceding chapter) since it is the purpose of the model to select the efficient set of portfolios from a given set of securities, as has been proved already by Markowitz [11] and others. The six portfolios were selected out of the efficient set on the basis of portfolio size and maximal return for a given level of risk.

Portfolio L is composed of forty stocks. These stocks had the highest historical holding period returns during the 1946-55 period. This portfolio was selected as a portfolio of the same size and ex ante risk as portfolio F to determine if it would outperform that portfolio in terms of holding period returns during the performance periods. The stocks in portfolio F are those held by a large mutual fund which follows the buy and hold strategy.

Portfolios M, N, O and P were all selected from these same forty stocks. Drawing portfolios in this manner allows some consideration of the appropriate portfolio size problem which is, of course, interesting in its own right.

Portfolio M includes thirty stocks. It is composed of the thirty stocks (of the forty included in portfolio L) which had the highest

historical holding period returns. These stocks were selected by the model as a portfolio of the same size and by ex ante risk as portfolio D. The stocks included in portfolio D are the same thirty presently included in the Dow Jones Industrial Average, a well-known market index. Portfolio M was selected to determine whether it would outperform portfolio D in terms of holding period return during the performance periods.

Portfolio N is composed of twenty-eight stocks. These stocks had the highest historical holding period returns during the input period. They were selected as a portfolio of the same size and ex ante risk as portfolio C to determine if portfolio N would outperform portfolio C in terms of holding period return during the performance periods. The stocks in portfolio C are those held by a large mutual fund which follows the buy and hold strategy.

Portfolio O includes twenty-five stocks. These are the twenty-five stocks with the highest historical holding period returns during the input period. They were selected as a portfolio of the same size and ex ante risk as portfolio E to determine whether portfolio O would provide greater holding period returns in the performance periods than portfolio E. The stocks in portfolio E are those presently included in the New York Times Industrial Index.

Portfolio P is composed of twenty stocks. These twenty stocks are those which had the highest historical holding period returns during the input period. They were selected as a portfolio of the same size as the random portfolios G through K inclusive to determine if portfolio O would provide greater holding period returns during the performance periods than the random portfolios G through K. This portfolio is also intended for comparisons with the other computer selected portfolios L through Q (especially portfolio Q), and the optimal and minimal portfolios A and B.

(Further information on portfolios A through K is provided in the following section).

Portfolio Q contains twenty stocks. These twenty stocks were chosen from the 260 stocks remaining in the reduced sample after the forty stocks used for portfolios L through P had been removed. The stocks included in this portfolio are those still remaining in this further reduced sample which had the highest historical holding period returns during the input period. This portfolio is intended for comparisons with the random portfolios G through P (especially portfolio P) and the optimal portfolios A and B. Since portfolio Q includes the third "best" twenty stocks selected by the computer model it can be construed to indicate representative "poor" computer assisted portfolio selection. This portfolio also allows some consideration of the appropriate portfolio size problem by showing, suggestively, what the effects of larger portfolio size on performance might be. Portfolio Q is still expected to provide greater holding period returns during the performance periods than the random portfolios G through K.

Reference Portfolios

Portfolio C is composed of the 28 stocks held by the Corporate Leaders Trust Fund Certificate Series B Mutual Fund. It is included as being representative of an institutional investor which follows the buy and hold, equal shares strategy. The investment policy objectives of this fund are long term capital growth with reasonable income. It is felt that this policy is typical of many institutional and individual investors. This fund was created in 1935 to invest in the stocks of only 28 large, blue chip companies. It holds all new funds inflows until an amount sufficient to purchase an equal number of shares of each of the 28 stocks is accumulated, then it invests in all of the stocks at one time, ignoring any timing considerations which might influence other investors. Although its portfolio list of 28 stocks was originally selected in 1935 and has never been changed, any investor who chose to buy this mutual fund in 1956, 1957, or 1958 selected, at that time, this 28 stock portfolio.

Portfolio D is composed of the thirty stocks which are currently included in the Dow Jones Industrial Average, a famous market indicator which investors frequently are advised to "buy" and an indicator of "par" stock investment performance which is used by some investment managers as a target and by others as means for fixing their compensation (Competitive Capital Fund and Enterprise Fund managers, for instance, are compensated on a sliding scale for outperforming the Dow Jones Industrial Average). It is included here for comparative purposes as an indicator of general market performance, as an indicator of "par",

and because it is a portfolio of approximately the same size as portfolios C, E, and F, thus representing a valid alternative to investors interested in a mechanical portfolio selection procedure. This portfolio indicates the performance which an investor could reasonably expect from a "buy the average" policy.

Portfolio E is composed of the twenty-five stocks which are currently included in the New York Times Industrial Index. It is included for the same reason as Portfolio D. It represents a reasonable alternative portfolio, of approximately the same size, to portfolios C, D, and F. It is a much less well-known market index but since it is published by an important, widely read newspaper it can be expected to be familiar to most institutional and many individual investors all over the United States. This portfolio also represents the performance which an investor could expect from a "buy the average" policy.

Portfolio F is composed of the forty stocks held by the Founders Mutual Fund. It is included as being representative of an institutional investor which follows the buy and hold, equal dollar strategy to implement its investment policy objectives of long term growth of capital with reasonable income. This fund was created in 1938 to invest in the stocks of forty large, blue chip companies. It holds all new funds inflows until an amount sufficient to purchase a number of shares of each of the forty stocks in equal dollar amounts is accumulated, then it invests in all of the stocks at one time, ignoring timing considerations. It is included because it represents the same type of investor as portfolio C but it follows a different implementation strategy in attempting to achieve the same goals. Although its portfolio list of forty stocks was originally selected in 1938 and has never been changed, any investor who chose to buy this mutual fund in 1956, 1957, or 1958 selected, at that time, this forty stock portfolio.

The five portfolios, G through K inclusive, are each composed of twenty stocks selected randomly from the basic sample. They are included for comparative purposes as representative of the performance which could be obtained by simple random selection of portfolios. Twenty stocks are included in each of these random portfolios because twenty is the minimum size which will satisfy the basic law governing mutual funds, the Investment Company Act of 1940, and this law, which was adopted by Congress after considerable investigation and debate, presumably indicates the consensus of the best informed opinion on the subject of "prudent" investment management policy. The average performance of all five random portfolios, which include a total of 100 stocks, a 15% sample of our basic 665 stock universe, should be statistically representative for comparative purposes. It is to be expected that the computer selected and mutual fund portfolios C, F, L, M, N, O, P and Q would all outperform these random portfolios, G through K inclusive, if management really does count, as many mutual funds advertise that it does, although some academicians assert that there is no evidence to support this claim [5].

While all of the preceding portfolios C through Q inclusive, were selected once and their composition remained unchanged for all three performance periods, the reference portfolios A and B were selected independently for each of the performance periods. These two portfolios each contain twenty stocks but the twenty stocks are not the same for each performance period as is the case for all the other portfolios.

The A portfolios include the twenty stocks of the 665 stock basic sample which had the highest ex post holding period returns for each of the three performance periods. They indicate the maximum possible holding period return which could have been achieved by any portfolio chosen from the basic sample for a given performance period. Such portfolios indicate

the optimum performance which could have been obtained from ex ante portfolio selection only by an investor who knew, in advance, and with certainty, the future performance of each of the stocks in the basic sample; hence, it is extremely unlikely that any real life investor could actually ever do so well. Portfolio A is included in this study for comparative purposes since it does indicate the optimal performance obtainable from stocks selected from the basic sample.

The B portfolios include the twenty stocks of the 665 stock basic sample which had the lowest ex post holding period returns for each of the three performance periods. They indicate the lowest possible holding period return (actually a loss) which could have been achieved by any portfolio chosen from the basic sample for a given performance period. They are included for comparative purposes as an indicator of minimal performance.

Table 3 presents summary information on the composition and characteristics of each of the seventeen portfolios.

TABLE 3

SELECTED AND REFERENCE PORTFOLIOS

Identifier	Portfolio Name	Size	Type	Purpose
A	Optimal	20	Reference	Indicates "Best" Performance
B	Minimal	20	Reference	Indicates "Worst" Performance
C	Corporate Leaders Fund	28	Reference	Indicates Mutual Fund Performance
D	Dow Jones Average	30	Reference	Indicates Market Performance
E	New York Times Index	25	Reference	Indicates Market Performance
F	Founders Fund	40	Reference	Indicates Mutual Fund Performance
G	Random 1	20	Reference	Indicates Random Performance
H	Random 2	20	Reference	Indicates Random Performance
I	Random 3	20	Reference	Indicates Random Performance
J	Random 4	20	Reference	Indicates Random Performance
K	Random 5	20	Reference	Indicates Random Performance
L	Efficient 1	40	Selected	Comparison with Portfolio F
M	Efficient 2	30	Selected	Comparison with Portfolio D
N	Efficient 3	28	Selected	Comparison with Portfolio C
O	Efficient 4	25	Selected	Comparison with Portfolio E
P	Efficient 5	20	Selected	Comparison with Random Portfolios
Q	Third Best	20	Selected	Comparison with Random Portfolios

Simulation Time Periods

The data base was split into two parts at a time when only the 1965 COMPUSTAT tape was available. These two parts are the history input period 1946-1955 and the first performance period 1956-1965. As later editions of the tape became available two more performance periods, 1957-1966 and 1958-1967, were established so as to be able to evaluate the sensitivity of the model and provide the necessary statistical data for evaluation purposes.

The base year 1946 was selected because this is the first year for which COMPUSTAT data are available, but more importantly because it marks the start of a new era in the economic life of the United States. The Employment Act of 1946 gives the Unites States government the responsibility for attempting to stabilize the economy through counter cyclical monetary and fiscal policy. It is to be expected, therefore, that economic fluctuations during the post 1946 period will be less severe than those experienced previous to 1946.

The ten-year time periods beginning with 1946 were selected for input and evaluation periods because ten years should provide ample opportunity to observe normal performance of a company and its stock over a complete business cycle but a shorter time period might not be adequate for this purpose; ten years is the most commonly used period for mutual fund accumulation plans, ten years is the minimum period for which a reversionary trust can be established, ten years is also the maximum period of time the computer program can handle for input data consideration, and it was desired to use equal input and evaluation time periods.

At any time which could have been selected, institutional investors did, in fact, invest, so it was decided to assume that all simulated investments were made on the first business day of the year and liquidated on the last business day of the year ten years later. Price data for these dates are available on COMPUSTAT and since most companies report annual financial data at the end of the calendar year the fundamental information of primary interest to investors becomes available also at the end of the year.

During the three ten-year performance periods 1956-1965, 1957-1966, and 1958-1967 the trend of common stock prices has generally been upward. In order to minimize any bias which might be introduced by the choice of these particular time periods, since some time periods had to be chosen, an optimal and minimal portfolio of twenty stocks each were selected ex post so the performance of all the other portfolios could be evaluated in terms of the best and worst performance which might have been realized by investors, in only the stocks contained in the data base used for this study, during these particular time periods.

Simulation Results

After the appropriate stocks for each of the seventeen portfolios had been selected, an assumed investment of $100,000 was made in each portfolio at the beginning of the performance holding period and liquidated at the end of the period. Both the equal dollar strategy of investing equal dollar amounts at a time in each of the portfolio securities and the equal shares strategy of investing in an equal number of shares of each of the portfolio securities were followed in order to allow consideration of the relative merits of each strategy. It was found that there is no statistically significant difference in the results obtained from the two strategies, hence neither one can be said to be superior to the other.

Transactions costs and taxes were ignored primarily so the results of this study could be compared with the research of others who also ignored transactions costs and taxes. Since it is the quality of portfolio selection which is being evaluated and any other portfolio which could have been selected at the same time would have been subject to similar transactions costs, adjustment for these costs would add nothing to the study but complicated calculations. Liquidating transactions costs on other portfolios which might have been selected at the beginning of the performance period might, of course, differ significantly from those of the simulation portfolios but this type of adjustment is even more difficult to envision, if it could be done at all, and might not contribute much to the results either.

The investment management decision makers, since they manage other people's money, do not pay any taxes themselves as a result of their decisions unless their compensation is based on results rather than assets managed so taxes are ignored. The mutual funds do not usually pay any taxes themselves but their stockholders do, and presumably the mutual fund investment decision makers do consider tax effects. Since their decisions, if affected by taxes at all, would most likely be influenced by the marginal tax rates applicable to their stockholders and this information is unknown, the decision makers would have to arbitrarily assume some tax status as typical and then act accordingly. In this simulation study the ordinary tax rate was assumed to be 50% and the capital gains tax rate 25% and stocks were selected with this in mind but the portfolio results reported in this chapter have not been adjusted to give these rates an effect on the performance results. The liquidating values of the portfolio represent the before tax performance of the portfolio and indicate what the investment managers would have accomplished with the funds under their control. It is expected, therefore, that neither transactions costs or taxes would have any significant effect on the conclusions of this study.

Table 4 presents a summary of the results achieved by the seventeen portfolios during the 1956-1965 holding period. Table 5 summarizes the 1957-1966 period results, while table 6 presents the 1958-1957 record.

Detailed information for each portfolio for each of the three holding periods is presented in Appendices C through H, inclusive.

The performance of portfolios A and B over the three performance periods indicates that it was possible to achieve as much as a 3,111% gain or a 47% loss from portfolios of the same size and approximately equivalent ex ante riskiness, thus indicating that proper portfolio

selection can make a significant difference in performance.

The computer selected portfolio L, which had approximately the same degree of ex ante riskiness as reference portfolio F but a higher degree of diversification, very conclusively outperformed portfolio F by providing on average six times as much return, over the three performance periods!

Computer portfolio M similarly outperformed portfolio D while portfolio N did much better than portfolio C, and portfolio O outperformed portfolio E, thus demonstrating consistent superiority for the model when compared with mutual funds and market indices.

The performance of the two mutual fund portfolios, C and F, appears not significantly different from the performance of the two market index portfolios, D and E. While portfolio E outperforms D in terms of return, it is also more risky. Both of the index portfolios D and E are more diversified than the mutual fund portfolios but this difference does not appear to be significant. It is, however, of interest to note that portfolio F is considerably less risky than the other three portfolios yet its return is nearly as great, indicating that portfolio F performs its job quite well, especially if the equal shares strategy is followed since it then provides a higher return at less risk than the other three.

While it might therefore be concluded that portfolio F represents very good portfolio selection and performance it should be reemphasized that the computer selected portfolio L, which was selected by the model as an even better portfolio for the same level of risk, provides greater diversification and much more (four to eight times as much) return! This very impressive performance clearly justifies the inference that the model can do better than "par" or a typical mutual fund.

Although some writers, such as Friend and Vickers [5], assert that

random selection can provide better returns than mutual fund managers, the simulation results suggest that this assertion is false when risk is considered. The five random portfolios, G through K, do provide approximately twice as much return, on average, as portfolio F but they also are approximately twice as risky! It therefore appears that there is no significant difference, when risk is considered, between random selection and either the market index or mutual fund portfolios, although the random portfolios are more diversified.

On the basis of these simulation results it can be concluded that all of the computer portfolios, L through Q, consistently and significantly outperform the reference portfolios B through K inclusive, by providing greater holding period returns at the same or lower levels of ex ante risk.

It was expected that one of the two strategies, equal dollar and equal shares, would prove to be superior to the other. As can be seen from tables 4-6 the equal dollar strategy did consistently provide higher returns, but most of the time, this superior performance was accomplished only at higher risk levels. The differences in the performance obtained from each strategy, adjusted for risk, are not statistically significant, hence, neither can be said to be consistently superior to the other, although the equal dollar strategy does appear to be easier to implement. The equal dollar strategy has been used by most previous researchers.

TABLE 4

1956-1965 PORTFOLIO HOLDING PERIOD RETURN RESULTS

	Portfolio	Diversification Index	Number of Stocks	Equal Dollar Strategy Return	Equal Dollar Strategy Risk Index	Equal Share Strategy Return	Equal Share Strategy Risk Index
A	Optimal	.800	20	2,060.2%	5.000	1,814.5%	4.773
B	Minimal	.800	20	-28.2%	4.997	-30.2%	4.256
C	Corporate Leaders Fund	.643	28	159.9%	3.568	111.3%	3.187
D	Dow Jones Average	.700	30	141.9%	3.327	95.4%	3.262
E	New York Times Index	.760	25	181.0%	3.995	88.6%	3.464
F	Founders Fund	.675	40	179.0%	2.497	127.7%	2.461
G	Random 1	.800	20	196.4%	4.990	108.4%	3.931
H	Random 2	.850	20	368.2%	4.999	139.9%	5.351
I	Random 3	.800	20	254.8%	4.999	160.8%	4.964
J	Random 4	.950	20	197.8%	5.002	93.2%	4.922
K	Random 5	.900	20	391.6%	4.999	134.2%	4.898
L	Efficient 1	.750	40	830.0%	2.499	522.4%	2.626
M	Efficient 2	.833	30	784.0%	3.334	422.6%	3.465
N	Efficient 3	.821	28	741.4%	3.571	446.4%	3.786
O	Efficient 4	.840	25	733.0%	3.846	499.8%	4.065
P	Efficient 5	.900	20	816.5%	5.001	537.7%	5.200
Q	Third Best	.950	20	623.3%	5.001	349.2%	5.716

TABLE 5

1957-1966 PORTFOLIO HOLDING PERIOD RETURN RESULTS

	Portfolio	Diversification Index	Number of Stocks	Equal Dollar Strategy Return	Equal Dollar Strategy Risk Index	Equal Share Strategy Return	Equal Share Strategy Risk Index
A	Optimal	.700	20	1,470%	5.000	1,081%	4.425
B	Minimal	.600	20	-45.8%	5.000	-46.9%	4.556
C	Corporate Leaders Fund	.643	28	129.4%	3.568	85.5%	3.216
D	Dow Jones Average	.700	30	108.2%	3.332	65.9%	3.359
E	New York Index	.760	25	140.9%	3.999	55.7%	3.578
F	Founders Fund	.675	40	130.9%	2.505	93.5%	2,506
G	Random 1	.800	20	163.6%	5.000	86.4%	4.021
H	Random 2	.850	20	302.4%	5.001	116.9%	5.344
I	Random 3	.800	20	200.6%	4.999	104.2%	5.033
J	Random 4	.950	20	193.9%	4.999	74.2%	4.853
K	Random 5	.900	20	291.5%	5.000	123.3%	4.842
L	Efficient 1	.750	40	856.8%	2.499	589.2%	2.661
M	Efficient 2	.833	30	686.3%	3.345	435.6%	3.505
N	Efficient 3	.821	28	715.2%	3.571	448.1%	3.786
O	Efficient 4	.840	25	751.5%	4.000	485.9%	4.131
P	Efficient 5	.900	20	808.8%	4.999	517.3%	5.135
Q	Third Best	.950	20	446.6%	5.000	286.8%	5.682

TABLE 6

1958-1967 PORTFOLIO HOLDING PERIOD RETURN RESULTS

	Portfolio	Diversification Index	Number of Stocks	Equal Dollar Strategy Return	Equal Dollar Strategy Risk Index	Equal Share Strategy Return	Equal Share Strategy Risk Index
A	Optimal	.900	20	3,110.7%	5.007	2,744.5%	4.681
B	Minimal	.650	20	-7.5%	4.996	-.16%	3.647
C	Corporate Leaders Fund	.643	28	173.8%	3.573	124.4%	3.086
D	Dow Jones Average	.700	30	176.4%	3.335	130.5%	2.990
E	New York Times Index	.760	25	275.8%	4.000	120.1%	3.372
F	Founders Fund	.675	40	214.9%	2.500	171.8%	2.356
G	Random 1	.800	20	365.1%	5.001	250.8%	4.208
H	Random 2	.850	20	527.6%	5.000	289.2%	5.168
I	Random 3	.800	20	491.1%	4.999	221.6%	4.812
J	Random 4	.950	20	304.2%	4.999	236.7%	4.771
K	Random 5	.900	20	416.5%	4.999	198.6%	4.695
L	Efficient 1	.750	40	1,653.9%	2.500	1,307,1%	2.678
M	Efficient 2	.833	30	1,402.3%	3.334	1,049.4%	3.511
N	Efficient 3	.821	28	1,321.3%	3.571	1,059.6%	3.779
O	Efficient 4	.840	25	1,374.1%	3.999	1,075.1%	4.129
P	Efficient 5	.900	20	1,470.7%	5.000	1,054.1%	5.049
Q	Third Best	.950	20	815.6%	5.001	642.2%	5.878

Notes to Tables 4-6

1. The Diversification Index is computed by the following formula:

$$DI = \frac{I}{S}$$

where I = the number of different Standard and Poor's Industry categories represented in the portfolio, and

S = the number of stocks in the portfolios.

2. The Holding Period Return is computed by the following formula:

$$HPR = \frac{DI + CG}{CB}$$

where DI = Dividend Income received during the holding period,

CG = Capital Gain = Ending Price - Beginning Price,

CB = Cost Basis of original investment, and

HPR = Holding Period Return, expressed as a rate or percentage of original investment. (See page 52.)

3. The Portfolio Risk Index is computed by the following formula:

$$RI = \frac{\Sigma\, I_i\, C_i}{\Sigma\, C_i} /\$1000$$

where I = Initial Investment in dollars,

C = Risk Class Designation (see table 2), and

i = Each Individual Security.

(This Risk Index was suggested by Professor James G. Richardson of the University of Florida, who uses a similar index regularly for decision making in his capacity as trustee for a charitable trust fund.)

Portfolio Efficiency

In an attempt to facilitate analysis of portfolio performance the following one-dimensional return-risk measure is used: the portfolio efficiency index. It is computed by dividing a return measure by an ex post risk measure and multiplying the quotient by 100 according to the following formula: $EI = \frac{R}{V}(100)$

where R = Holding Period Rate of Return, and

V = Coefficient of Variation of Holding Period Return. (This risk measure is different from that employed in tables 4-6.)

The ex post performance of any portfolio can then be compared with the optimal performance which could have been realized during the holding period by dividing the individual portfolio efficiency index by the optimal portfolio index to arrive at the percentage of optimal performance achieved by a particular portfolio. Tables 7 and 8 present these data.

Performance comparisons in terms of average efficiency, over the three performance periods, with both the equal dollar and equal shares strategies are quite interesting. The two market portfolios, D and E, provide only 8% average efficiency in portfolio performance; while the mutual fund portfolios, C and F, did much better at 13.7% efficiency; the random portfolios, G through K, did very nearly as well at 13.2% efficiency. The computer selected portfolios, L through Q, provide significantly superior efficiency, on average, of 40.2%, nearly three times the performance of the random and mutual fund portfolios and five times that of the "market"!

TABLE 7

PORTFOLIO EFFICIENCY, EQUAL DOLLAR STRATEGY

Portfolio	Mean Annual Holding Period Return	Coefficient of Variation	Efficiency Index	Percentage of Optimal	Rank
A	1,[illegible]13.[illegible]	30.7%	7220	100%	1
B	-37.[illegible]	57.3%	NA	NA	17
C	154.4%	11.8%	1305	18.1%	10
D	14[illegible].[illegible]	19.7%	721	10.0%	14
E	1[illegible]9.[illegible]	28.5%	700	9.7%	15
F	174.[illegible]	19.8%	835	12.3%	11
G	[illegible]41.7%	36.5%	662	9.2%	16
H	3[illegible].4%	23.7%	1637	23.4%	9
I	[illegible]15.5%	40.0%	789	10.9%	13
J	[illegible]	26.9%	826	11.4%	12
K	[illegible].5%	14.[illegible]	2476	34.3%	8
L	1,11[illegible]	34.3%	3245	44.9%	4
M	[illegible]57.3%	33.[illegible]	2884	40.0%	6
N	[illegible]	30.[illegible]	3066	42.5%	5
O	[illegible]	15.[illegible]	6262	86.7%	2
P	1,0[illegible]	30.1%	3433	47.6%	3
Q	[illegible].5%	24.0%	2621	36.3%	7

TABLE 8

PORTFOLIO EFFICIENCY, EQUAL SHARES STRATEGY

Portfolio	Mean Annual Holding Period Return	Coefficient of Variation	Efficiency Index	Percentage of Optimal	Rank
A	1,880.0%	36.2%	5192	100.0%	1
B	-25.8%	74.7%	NA	NA	17
C	107.1%	14.9%	720	13.9%	8
D	97.3%	27.0%	360	6.9%	13
E	88.1%	30.0%	294	5.7%	15
F	131.0%	24.5%	535	10.3%	11
G	148.5%	49.1%	302	5.8%	14
H	182.0%	42.0%	434	8.4%	12
I	162.2%	29.6%	549	10.6%	10
J	134.7%	53.9%	250	4.8%	16
K	152.0%	22.0%	692	13.3%	9
L	806.2%	44.1%	1829	35.2%	3
M	635.9%	46.0%	1383	26.6%	6
N	651.6%	44.3%	1472	28.3%	5
O	686.9%	40.0%	1718	33.1%	4
P	703.0%	35.4%	1989	38.3%	2
Q	426.1%	36.3%	1173	22.6%	7

Significance Test of the Simulation Results

The standard t test for statistical significance of the differences between means is used to test the hypothesis that the performance of the computer selected (Markowitz model) portfolios is superior to that of the randomly selected portfolios, realized holding period returns, of course, being the only valid criterion for comparison [5, p. 392].

The null hypothesis of no difference between the means other than that attributable to random, chance factors is the hypothesis actually tested by the statistical procedure.

Since the calculated values of t are much larger than the table values of t at the .01 level of significance, the null hypothesis can be rejected and it can be assumed that the observed differences in mean holding period rates of return are not random but are due to the superior discriminating power of the Markowitz portfolio selection procedure. (Tables 9 and 10 present the results of this statistical test.)

The calculated values of t are even much larger than the table values of t at the .001 level of significance, thus lending even stronger support to acceptance of the hypothesis that the model can provide superior performance.

Since the performance of the mutual fund portfolios is not significantly different from that of the random portfolios in terms of efficiency, it follows that the model also significantly outperforms the mutual fund portfolios. Both the random and mutual fund portfolios were much more efficient than the market portfolios; therefore, the model also is superior to the market portfolios.

TABLE 9

SIGNIFICANCE TEST RESULTS FOR COMPUTER AND RANDOMLY SELECTED PORTFOLIOS
EQUAL DOLLAR STRATEGY AND HOLDING PERIOD RATES OF RETURN

	1956-65 Period		1957-66 Period		1958-67 Period		All Periods	
	Computer	Random	Computer	Random	Computer	Random	Computer	Random
Mean Return	754.7%	281.8%	710.9%	244.4%	1,344.7%	420.9%	936.8%	309.0%
Variance	4,710.3	6,897.3	17,118.9	3,701.9	65,807.7	6,612.9	22,582.7	4,736.2
Standard Deviation	68.6	83.1	130.8	60.8	256.3	81.3	150.3	68.8
Coefficient of Variation	9.1%	29.5%	18.4%	27.1%	19.1%	19.3%	16.0%	22.3%
Standard Error	942.1	1,724.3	3,423.8	925.5	13,161.5	1,653.3	4,516.6	1,184.1
Calculated t	9.159		7.377		7.590		8.315	

Table Value of t for two-tailed test at .01 level of significance with 9 degrees of freedom = 3.250

Table Value of t for two-tailed test at .001 level of significance with 9 degrees of freedom = 4.781

TABLE 10

SIGNIFICANCE TEST RESULTS FOR COMPUTER AND RANDOMLY SELECTED PORTFOLIOS
EQUAL SHARE STRATEGY AND HOLDING PERIOD RATES OF RETURN

	1956-65 Period		1957-66 Period		1958-67 Period		All Periods	
	Computer	Random	Computer	Random	Computer	Random	Computer	Random
Mean Return	463.0%	127.3%	460.5%	101.0%	1,031.3%	239.4%	651.6%	155.9%
Variance	5,764.6	569.7	8,548.1	338.4	38,402.1	408.6	13,125.9	241.8
Standard Deviation	75.9	28.9	92.5	18.4	196.0	20.2	114.6	15.6
Coefficient of Variation	16.4%	18.8%	20.1%	18.2%	19.0%	8.4%	17.6%	10.0%
Standard Error	1,152.9	142.4	1,709.6	84.6	7,680.4	102.1	2,625.2	60.6
Calculated t	9.328		8.487		8.977		9.565	

Table Value of t for two-tailed test at .01 level of significance with 9 degrees of freedom = 3.250

Table Value of t for two-tailed test at .001 level of significance with 9 degrees of freedom = 4.781

Additional Tests

Since the two mutual funds which were selected for reference purposes at the beginning of the simulation both follow the buy and hold strategy of investment with either the equal dollar or equal shares tactic it was decided to also compare the performance of the computer selected portfolios with the performance of many actual mutual funds which follow diverse policies and engage in considerable trading over time. It is assumed that these funds engage in such trading because they feel that results superior to buy and hold will be forthcoming. It is this hypothesis which is tested.

A sample of performance data for 256 large and well-known mutual funds was available in the Fundscope Annual Mutual Fund Guide [6]. A sample was selected for this study from these 256 mutual funds according to two criteria: availability of complete time series data, and investment objectives. Deletion of foreign and predominantly non-common stock funds further reduced the sample to 100, a convenient and statistically meaningful size.

These one hundred mutual funds are classified by Fundscope into the following categories: growth only, growth with income, income with growth, balanced, and income only. They represent a wide range of investment strategy and tactics combinations and provide a very broad spectrum of performance and risk characteristics. They are also subject to a wide variety of constraints.

The average (mean) holding period return for the mutual funds of each group, and for all 100 funds, is reported in table 11. It was not

possible, with the existing data, to calculate the ex ante risk index, at the beginning of each performance period, for each mutual fund.

The performance of the total sample of mutual funds is not significantly different from that of reference portfolio F in terms of return, thus indicating that it was a good choice as a typical mutual fund. These data allow rejection of the hypothesis that mutual funds which engage in frequent portfolio trading over time perform better than those which follow a buy and hold policy.

The growth funds group outperformed the other groups of mutual funds in the sample, indicating that mutual fund managers are able to discriminate between high performance portfolios and those of lower performance.

Comparison with the random portfolios is quite interesting in view of the Friend and Vickers [5, p. 414] assertion that mutual funds cannot perform better than random selection. The data presented in table 12 indicate that random portfolios do provide higher returns but in two of the three performance periods this superior performance was obtained only at much higher levels of ex post risk (as measured by the coefficient of variation of return); however, in the third period much higher returns at lower risk were obtainable from the random portfolios. This comparison of mutual fund and random selection is inconclusive so it is not possible to either support or refute the Friend and Vickers hypothesis.

It is possible, however, to reassert that the computer selected simulation portfolios outperformed random and mutual fund selection since it was previously established that they were superior to both random and portfolio F selection and portfolio F has now been shown to be not significantly different in return characteristics from the actual performance of 100 mutual funds. It can further be asserted that the Markowitz model is superior to any other portfolio selection method currently used by

institutional investors for achieving high holding period returns at specified risk levels subject to minimal constraints.

TABLE 11

MUTUAL FUND PERFORMANCE

Group Number	Objective	Number of Funds	1956-1965 Mean HPR	1957-1966 Mean HPR	1958-1967 Mean HPR
1	Growth only	24	205.2%	171.9%	366.7%
2	Growth with Income	29	171.9%	137.7%	235.6%
3	Income with Growth	15	168.9%	128.2%	211.1%
4	Balanced	22	128.1%	106.0%	155.0%
5	Income only	10	135.8%	112.4%	204.2%
All Sample Mutual Funds		100	166.2%	135.0%	242.5%
Reference Portfolio F (Equal Dollar)			179.0%	130.9%	214.9%
Reference Portfolio F (Equal Share)			127.7%	93.5%	171.8%
Reference Portfolio F (Average)			153.4%	112.2%	193.4%

TABLE 12

MUTUAL FUND AND RANDOM PORTFOLIO PERFORMANCE

	1956-1965	1957-1966	1958-1967
All Sample Mutual Funds, Mean Holding Period Return	166.2%	135.0%	242.5%
Coefficient of Variation	17.1%	17.9%	30.3%
Reference Random Portfolio, Mean Holding Period Return	281.8%	224.4%	420.9%
Coefficient of Variation	29.5%	27.1%	19.3%

Portfolio Size

The 256 mutual funds listed in the Fundscope Mutual Fund Guide [6] hold an average of 72 different portfolio issues with a minimum of 20 and a maximum of 569 issues observed.

The simulation results reported herein indicate that the optimal portfolio size is likely to be in the 20 to 60 issue range while portfolios which contain very large numbers of different issues are likely to be poor performers. The "worst" computer portfolio, Q, was still almost twice as good, in terms of holding period return at the same ex ante risk level, as the best of the random portfolios, thus suggesting that portfolios of size 100, selected by the model, will still be superior to random selection.

This finding, although not conclusively proven, does lend support to the assertion often made by institutional investors that only 100 or 200 institutional investment quality issues exist. Institutional investors sometimes disagree as to which 100 or 200 stocks deserve this appelation but as a normative concept, at least, such an assertion seems valid.

On the other hand, the simulation results rather conclusively prove that a computer, with a mechanistic security analysis procedure, cannot select the one "best" stock at any given time, as some investment advisory services would have their customers believe.

An analysis of the performance of portfolios L through P is informative on this aspect of the portfolio size problem. Portfolio L contains the forty best ex ante stocks and portfolios M, N, O, and P contain

smaller subsets of portfolio L but all provide lower return at higher risk! Table 13 presents information on the predicted and actual holding period return of the "best" twenty stocks. It is obvious that past information on any individual stock is a poor predictor of future performance; however, when several stocks are combined into a portfolio many of these prediction errors cancel out and quite good performance can be obtained from the portfolio. Since it is impossible to know the future, errors in prediction must be expected and diversification has long been the recommended method for dealing with this problem. It has been definitely established that the Markowitz model accomplishes the efficient diversification of investment portfolios.

TABLE 13

PREDICTED AND ACTUAL RETURNS

Company	1956-1965 Holding Period Return Predicted	Actual
Alleghany Airlines	3,726.5%	226.2%
Allen Electric Equipment	3,736.5%	367.2%
American Beverage	1,372.5%	800.0%
American Motors	1,645.4%	417.6%
Avis Industrial	1,746.9%	631.5%
Baldwin (D. H.)	1,963.9%	366.8%
British Petroleum	2,005.6%	101.4%
Cenco Instruments	2,113.9%	1,849.6%
Crompton & Knowles	1,626.4%	470.4%
Crown Cork & Seal	2,507.5%	1,251.2%
Ethyl	3,767.9%	3,723.0%
Green Giant	1,957.4%	622.8%
Gulf & Western Industries	7,387.5%	1,374.0%
Heller (Walter E.)	1,948.0%	291.7%
Host International	2,970.3%	1,626.0%
Indian Head	1,583.7%	1,007.6%

TABLE 13 (Continued)

PREDICTED AND ACTUAL RETURNS

Company	1956-1965 Holding Period Return Predicted	Actual
Leesona	1,591.5%	413.6%
National Airlines	2,523.7%	298.3%
Pittsburgh Brewing	1,596.4%	456.6%
Publicker	1,899.4%	33.4%

The Random Walk Hypothesis

In the last decade, considerable interest in the random walk hypothesis of stock price behavior has been evidenced by academicians and investment practitioners and while this study has not been intended as a test of this hypothesis the results do have relevance to it. An extensive literature [1, 9] now exists on this topic.

The essential point of the random walk hypothesis is that successive price changes are independent and therefore it is not possible to predict future price behavior from past behavior alone. If this hypothesis is true then, obviously, market technicians, especially chartists, are wasting their time, hence, there is considerable interest in the hypothesis (and disbelief) on Wall Street. The hypothesis is compatible with a fundamental approach to stock selection since it usually assumes a perfect market in which prices change in accordance with the availability of new information which becomes available randomly.

The mechanistic security analysis procedure utilized in this study did assume that past experience was a valid predictor of future performance, and since the returns of portfolios selected in this manner were very much superior to those obtained from any other selection method it would appear that this study refutes the random walk hypothesis, at least for the time period under study.

Before accepting this conclusion it is advisable to consider some of the pertinent evidence. Empirical testing of the random walk hypothesis has usually consisted of statistical analysis of runs, serial correlation studies, and spectral analysis of time series of prices. These

statistical tests almost unanimously support the random walk hypothesis but they do have some important limitations which reduce their evidential value. Statistical tests do not generally test the principles which stock market technicians claim to use because of the restrictive nature of the statistical techniques, and it is frequently difficult to adequately and unequivocally interpret the statistical results, particularly in serial correlation studies and runs testing where the size of the correlation coefficient or the expected length of the run required for acceptance or rejection in an economic sense is difficult to specify.

Stock market prices are time series and it is both likely and possible that no time series really exhibits complete and perfect independence of successive changes. What is important economically, however, is that the dependencies of price changes, if they exist, may be so small that a trader, using only the past history of the time series, cannot consistently make money (after taxes and transactions costs) with any investment strategy based on historical inputs.

Although most of the statistical analyses of the random walk support the hypothesis they also do not consider the economic implications of transactions costs. Thus, the only economically significant studies of the random walk hypothesis can be simulation studies. While this study did not consider transactions costs the returns of the computer selected portfolios were so much higher than those of any other that, obviously, they would also be superior after adjustment for such costs. In this study, however, successive (in time) price changes are not studied, but instead the prices at particular points in time, followed by prices at other particular points in time are the major influence on portfolio returns. This study has used a ten-year differencing interval where the random walk hypothesis would use much shorter time periods, such as

a day, or a week, or perhaps even a month, to test the hypothesis. This study has not, therefore, been a direct test of the random walk hypothesis, but the results do suggest that the essential point of the random walk, that history cannot be used to predict future prices, has been refuted.

Further support for refutation of the random walk hypothesis is provided by Levy [10] who, in his dissertation, performed a simulation study of technical trading rules using a differencing interval of 26 weeks, among others, on a sample of 200 New York Stock Exchange stocks for the 1960-1965 time period. He found that trading with the 26-week interval was superior to a random selection buy and hold strategy but that shorter differencing intervals were not superior. His results suggest that perhaps successive price changes follow a random walk whenever the differencing interval is less than 26 weeks.

Another refutation of the random walk hypothesis has been provided by Davis [2] who studied the profitability of trading on the basis of point and figure charts. He investigated 1,100 charts over the 1954-1964 time period and pursued a mechanical trading policy of buying and selling according to the chart signals. Some transactions were closed out within 2 months while others were open for as long as 10 years, thus his differencing interval, ex post, is variable. His results indicate that it was possible, during his simulation time period, to consistently achieve net returns from trading of approximately 20%. When this is compared with the results of the latest Chicago study [4] which indicate that random selection is likely to produce a return not greater than 11% the point and figure technique appears to be worthy of further consideration by those who like to engage in frequent trading.

It therefore appears that simulation studies, although not yet very

numerous, generally refute the random walk hypothesis while statistical studies support it. In spite of the fact that the issue is not yet definitively resolved either way it would appear that the random walk should not be given much credence by long term investors, at this time, at least.

Implications for Investment Management

The results of this simulation, when considered in conjunction with other studies of investment performance [3, 4, 5, 7, 12], lead to some important conclusions concerning the behavior of institutional investment managers.

While this study indicates that the past investment success, or lack thereof, is not always a "good" predictor of future performance, it may not be a "bad" one either, since the computer selected portfolios in this simulation provided much higher returns at the same or lower risk than other portfolios. Since no other studies consider portfolio risk, as this one does, it is not possible to make any comparisons on this aspect of performance; however, other studies, emphasizing return only, are available, and in every instance the computer selected portfolios of this study provided higher returns! It is possible that either econometric forecasting or judgmental estimates by experienced security analysts can provide even better inputs to the Markowitz model and lead to even higher returns.

The results of this simulation are compared with those obtained by other researchers in table 15. In order to make such comparisons the holding period returns obtained in this study were first converted into equivalent effective compound rates of return by a computer program which calculated the rate of interest which would have been required to produce an ending investment equal to the liquidating value of the simulation portfolios from an original investment of the same size as the portfolio investment. These rates are reported in table 14 and their averages are

then compared with the rates of return obtained in other studies in table 15.

As can be seen from even a casual perusal of table 15 the computer selected portfolios provide significantly higher returns than those obtainable by other methods. The returns of the market portfolios and the fund portfolios are not significantly different from the average returns of the 100 mutual funds, suggesting that the trading activities of these mutual funds do not enhance their results. This evidence would tend to support the Friend and Vickers [5] assertion that mutual fund managers do not seem to be able to do either better or worse than the "market". Since the performance of the two buy and hold mutual fund portfolios is so similar to the performance of the 100 mutual funds which do engage in considerable portfolio turnover it would appear that from a return standpoint there is no advantage in either procedure but if risk is properly considered it may well be that judicious trading could reduce portfolio risk over time. It is reasonable to assume, however, that some mutual funds engage in excessive portfolio turnover since the random buy and hold policy provides higher returns and the foundations achieve an even higher return while also usually engaging in little trading activity. As was pointed out previously however, the random portfolios have higher risk than the fund portfolios; and, since the riskiness of the foundation portfolios has not been investigated, the evidence is not yet conclusive.

With respect to portfolio size, since the computer portfolios, the random portfolios, and the foundation portfolios all provided higher returns from portfolios containing fewer different issues than the sample 100 mutual funds, it is reasonable to conclude that many of the mutual funds have not only indulged in excessive portfolio turnover, but also

in excessive portfolio diversification in terms of the number of issues included.

The random portfolios of this simulation were chosen from a universe of 900 stocks; the Michigan [3] study, which obtained similar returns, used a universe of only 92 stocks; the Herzog [7] study, which achieved higher returns, used only ten stocks; and the Chicago [4] study, which obtained lower returns, utilized the largest size universe, all stocks listed on the New York Stock Exchange. These results suggest that the size of the perceived universe of potentially acceptable securities as well as the method of selection influence the results obtained. The Herzog study selected a sample of one security from each of ten classes, the Michigan study selected random portfolios from its universe of stocks which had a trading volume in excess of one million shares in 1936, while the Chicago and random portfolios of this study were selected randomly.

It appears, from this evidence, that it would be possible to select a sample from the universe of all stocks, perhaps with the aid of multiple discriminant analysis, such that any security selected for investment from this sample would have a very low probability of a small holding period loss and a very high probability of a satisfactory holding period gain. The Markowitz model could then be employed to select the optimal portfolio from this set, further reducing the probability of loss and enhancing the probability of gain.

Institutional investment managers, at the present time, do not do as well in performance as they could with the aid of the Markowitz model. This simulation study provides substantial proof for this assertion. Furthermore, many institutional investment managers appear to engage in excessive portfolio turnover and hold excessive numbers of different issues in their portfolios. It is therefore suggested that they decrease

portfolio size and portfolio turnover and employ the Markowitz model to achieve efficient diversification. This should lead to higher returns at no more risk than presently undertaken.

TABLE 14

EQUAL DOLLAR STRATEGY PORTFOLIO RESULTS

ANNUAL EQUIVALENT EFFECTIVE RATES OF RETURN

Portfolio	1956-1965	1957-1966	1958-1967	Average
A Optimal	36.0%	31.7%	41.5%	36.4%
B Minimal	-1.7%	-3.8%	-.7%	-2.1%
C Corporate Leaders Fund	10.0%	8.7%	10.6%	9.7%
D Dow Jones Average	9.2%	7.6%	10.7%	9.1%
E New York Times Index	10.9%	9.2%	14.2%	11.4%
F Founders Fund	10.8%	8.7%	12.1%	10.5%
G Random 1	11.5%	10.2%	16.6%	12.7%
H Random 2	16.7%	14.9%	20.2%	17.2%
I Random 3	13.5%	11.6%	19.5%	14.8%
J Random 4	11.5%	10.2%	15.0%	12.2%
K Random 5	17.3%	14.6%	17.9%	16.6%
L Efficient 1	25.0%	25.3%	33.2%	27.8%
M Efficient 2	24.4%	22.9%	31.2%	26.1%
N Efficient 3	23.2%	23.4%	30.7%	25.9%
O Efficient 4	24.2%	23.9%	30.9%	26.3%
P Efficient 5	24.8%	24.7%	31.7%	27.0%
Q Third Best	21.9%	19.5%	24.8%	21.7%
Average Computer (L-Q)	23.9%	23.1%	30.4%	25.8%
Average Random (G-K)	14.1%	12.3%	17.8%	14.7%
Average "Market" (D,E)	10.0%	8.4%	12.5%	10.3%

TABLE 14 (Continued)

EQUAL DOLLAR STRATEGY PORTFOLIO RESULTS

ANNUAL EQUIVALENT EFFECTIVE RATES OF RETURN

Portfolio	1956-1965	1957-1966	1958-1967	Average
Average "Fund" (C,F)	10.4%	8.7%	11.4%	10.2%
Mutual Fund Group 1	11.8%	10.5%	16.3%	12.8%
Mutual Fund Group 2	10.6%	9.1%	12.9%	10.8%
Mutual Fund Group 3	10.5%	8.7%	12.0%	10.4%
Mutual Fund Group 4	8.7%	7.6%	10.0%	8.8%
Mutual Fund Group 5	8.9%	8.0%	11.7%	9.6%
Total Mutual Fund Sample	10.1%	8.8%	12.6%	10.5%

TABLE 15

COMPARATIVE RESULTS, AVERAGE ANNUAL EFFECTIVE RATES OF RETURN

(Selected Periods)

Type of Portfolio	Return
Computer Selected Portfolios L-Q (1956-67)	25.8%
Randomly Selected Portfolios G-K (1956-67)	14.7%
Market Index Portfolios D & E (1956-67)	10.3%
Fund Portfolios C & F (1956-67)	10.2%
100 Mutual Funds (1956-67)	10.5%
Chicago Study of Stock Yields (1956-65)	12.4%
Michigan Study of Stock Yields (1950-61)	14.2%
Herzog Study of Stock Yields (1950-61)	16.3%
Nelson Study of Foundation Portfolios (1951-60)	19.8%

Summary

The results of the simulation studies undertaken to test the efficacy of the Markowitz model over the 1956-1965, 1957-1966 and 1958-1967 time periods, using historical inputs from the 1946-1955 time period, indicate that the model provided statistically significantly higher holding period returns at lower levels of risk than any other method tested.

Direct comparisons were made with the equal shares and equal dollar buy and hold investment strategies for selected mutual fund, market index, and randomly selected portfolios varying in size from 20 to 40 issues. In every case, computer selected portfolios provided higher returns at equal or lower ex ante risk levels. Indirect comparisons were made with many different implementation strategies and investment goal sets by comparing the actual performance of a sample of 100 large mutual funds with the computer selected portfolios. Again the computer selected portfolios provided superior returns.

The primary hypothesis that institutional investors could have selected portfolios with the model which were superior to those actually selected is accepted. The secondary hypothesis that the Standard and Poor's Stock Rating is an operationally efficient ex ante indicator of riskiness is also accepted.

Some implications of the study are: that it provides refutatory evidence for the random walk hypothesis that past performance cannot be used to predict future performance in the stock market since the study used a mechanistic security analysis procedure based on past performance and superior returns resulted, that optimal portfolio size is less than

that utilized by many institutional investors, and that the policy of buying and holding an appropriately selected and efficiently diversified portfolio is superior to a policy of frequent portfolio turnover, at least as far as returns are concerned.

Since most institutional investors must be aware of the Markowitz model by now, since it was first proposed in 1952, and they have computers, it must be assumed that they are not using the model for the "wrong" reasons. The results of this study indicate that they should use the model and if they do, they can expect to perform better than they have previously without it.

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CHAPTER 6

SUMMARY AND CONCLUSIONS

Introduction

The primary purpose of this study has been to evaluate the Markowitz portfolio selection model to ascertain its advantages, if any, over other methods of portfolio selection and to identify its major limitations.

This study was undertaken to partially fill the knowledge gap which then existed because no empirical research results concerning the practical usefulness of the model to institutional investors had yet been published, despite the availability of appropriate computer programs, machine time, and suitable data.

This study utilized a much larger data base and longer time span than any other project whose results have been published since this study began, and its results are therefore the most conclusive evidence presently available.

The results of this study confirm the hypothesis that the Markowitz model can be used to achieve much better investment performance than is commonly realized by the majority of institutional investors.

Institutional Investment and Computers

Financial institutions act as middlemen in the economy of the United States by bringing together the many, individually small, suppliers of investment capital and the relatively few, usually large, users of capital funds, thus contributing to the economic activity of the nation.

Commercial banks, savings banks, trust companies, credit unions, pension funds, insurance companies, savings and loan associations and investment companies are among the financial institutions which perform this important function.

These institutional investors already own or control (exercise decision making responsibility) approximately one third of all of the outstanding common stock in the United States and nearly as many of the electronic computers installed within the country.

The rapidly increasing importance of institutionalized investment in our nation puts two kinds of pressure on the financial institutions to use computers. The expanding bookkeeping chore involved in recording the myriad transactions and maintaining appropriate portfolio records is likely to exceed human capacity in the near future, if it has not already done so. The shortage of experienced human investment decision makers, the complexity of their work, and their ever increasing workload make it imperative that computers be used, at least for the routine mathematical calculation and data handling tasks, so the human decision makers can devote more of their time and unique capabilities to the more difficult and qualitative aspects of the investment process for which computers are not well suited.

The institutional investment process is a never ending cycle which is triggered whenever new funds become available for investment. It proceeds through the steps of forecasting the future, analysis of investment requirements, formulation of investment policy, search for appropriate alternative investment securities, analysis of securities, selection of portfolios, and analysis of portfolio results. This loop is sometimes shortened in actual practice if investment requirements and policy remain unchanged.

Computers can, of course, be employed at every stage of this process if appropriate programs can be created. At present, programs exist only for searching, security analysis, portfolio selection, and portfolio analysis. The survey results reported in Chapter Two indicate that financial institutions do not now make much use of either security analysis or portfolio selection programs but they do plan to at least double their computer utilization for these investment management purposes over the next few years.

Investment Decisions and Computers

Investment management is a specialized type of decision making problem which requires the allocation of a limited amount of investible funds to those few portfolio securities, from among an almost infinite array of possible alternative securities of various types and attributes, which appear, at a given time, most likely to achieve the investor's objectives, over some period of time, with the minimum of risk consistent with his objectives.

There is general agreement on the job to be done by the investment decision maker (achievement of maximal gains while minimizing risk) but there is considerable disagreement about the optimal manner of accomplishing this formidably difficult task.

Computers can assist the human decision maker in making these difficult decisions if they are programmed with appropriate models of decision processes. It is possible, by joint man-computer efforts, to make decisions faster than was previously possible, while also considering many more alternatives. The Markowitz model provides the kind of explicit instructions which the computer requires in order to do anything, since it cannot think. While this model may not be perfect it may be much better than any alternative presently available. The advent of the computer makes empirical testing and practical applications of this model feasible.

The Markowitz Model

The simplified version of the portfolio selection model, first proposed by H. M. Markowitz [3] in 1952, and used in this study requires, from its human user, estimates of: future devidend payments over some period of time (the holding period), the price of each security at the end of the holding period, and the performance of some index of general market performance during the holding period.

The computer implemented model then calculates the slope and intercept of the performance of each security in relation to the market index and translates this into a variance estimate for each individual security by itself and with each and every other security being considered for inclusion in the portfolio.

The model then calculates, with this information, the set of efficient portfolios, of specified size, which maximize return for a specified level of risk and minimize risk for a specified level of return, as well as all portfolios between these two, from among the set of available securities, which may be as large as three hundred. It performs this feat subject to any linear constraints imposed by the investor, such as requiring investment in certain stocks or industries or limiting investment of certain categories to specified levels. It merely does, mathematically, what the investor would do himself (if he could) in order to choose an optimal portfolio from among many alternatives, giving due consideration simultaneously to all the ramifications of all of the possible combinations of the available securities.

The theory of the Markowitz model treats the holding period return

(capital gain plus dividend income) as a random variable whose actual value is expected to vary in random fashion within limits specified by the security analysis procedure. Expected holding period return is the mathematical expectation (mean) of the subjective probability distribution of possible returns. Risk is measured by the statistical variance of expected returns since the fluctuations of actual values around the mean are most likely to be symmetric.

A key concept is that of the covariance, which is defined as the product of the variance of each security in each possible pair of securities and their correlation coefficient. The lower the correlation the greater the diversification of risk.

An acceptable portfolio is one composed of securities drawn from the set of available securities which meets all legal, natural and policy constraints. An efficient portfolio is an acceptable portfolio which either provides the greatest possible expected return for a given level of risk or the lowest possible expected risk for given level of expected return. The efficient portfolios with highest return and lowest risk are connected by a critical line which forms the efficiency frontier of the set of efficient portfolios. The investor must choose the appropriate portfolio for him from those along this efficiency frontier on the basis of the return-risk trade-off which is most appropriate for his own objectives.

Empirical Tests

The Markowitz model has so far been subjected to very little empirical testing. The basic model was extended by Sharpe [4] who showed that his index model produced portfolios almost identical with those of the basic model but at much less cost. Cohen and Pogue [1] provided corroborative evidence on the efficacy of the Sharpe index format and showed also that a single-index model provided better results for common stock investments than a multi-index model. All these tests used relatively small stock samples of size one hundred or less and covered short periods of time.

The simulation tests performed in this study utilize a much larger basic sample and longer time periods. A basic sample of 665 stocks was first screened to a reduced sample of 300 for further tests since this was the largest number of different stocks which could be handled by the computer facilities available for the support of this study. A history input period of ten years (1946-1955) is used to extrapolate holding period return estimates for the model to select portfolios, varying in risk and in size from 20 to 40 issues, for the three ten-year performance periods 1956-1965, 1957-1966, and 1958-1967.

Assumed investments of $100,000 were made on the first day of each of the performance periods, according to the equal dollar and equal shares strategies, in 17 portfolios (an optimal, minimal, 2 market index, 2 mutual fund, 5 random, and 6 computer selected) and these investments were then liquidated on the last day of the performance periods and the realized holding period returns were calculated.

The computer selected portfolios in this study achieved realized holding period returns approximately twice as large as those of the next best set of portfolios (random) at lower risk, thus proving that, even with mechanistic input data, the model can significantly outperform any other tested method of portfolio selection. This superior performance was statistically significant at the .01 level.

Since the Standard and Poor's Stock Ratings had been used as the basis for an ex ante portfolio risk index and portfolios with equivalent risk indices provided such different holding period returns it is concluded that these ratings provide an operationally useful risk indicator which further simplifies the practical use of the model and reduces the cost of using it.

As an additional test of the efficacy of the model the results of the computer selected portfolios were compared also with the actual performance, for the three performance periods, of a sample of 100 large, well-known mutual funds. The performance of these funds was found to be not significantly different from the two mutual funds which had been used in the original tests and again the computer selected portfolios provided significantly superior performance. Since these 100 mutual funds utilize just about every possible combination of investment policy strategies and most of them engage in frequent portfolio transactions it can be concluded that the Markowitz model provides better results than those obtainable by any other institutional investment management methodology.

Further evidence of the superiority of the Markowitz model is provided by translating the holding period returns into equivalent effective compound rates of interest and comparing the results obtained in this study with those found by other researchers. The average return of the computer selected portfolios was 25.8%; the Nelson [5] study of large foundations

indicates that they achieved an average return of 19.8% on their stocks; the famous Chicago [2] studies indicated a random return of 12.4%; while the sample 100 mutual funds of this study provided an average return of only 10.5%.

Implications

It would appear that financial institutions which do not yet use the Markowitz model are remiss in their responsibilities to their investors and/or their stockholders since they apparently could have obtained much higher returns at less risk during the performance periods used in this study than they actually did.

The superior performance of the computer selected portfolios in this study was the result of a mechanistic, historical security analysis procedure. It is quite likely that more accurate input data can be generated by experienced security analysts such as those usually employed by large institutional investors. In that case expected performance would, of course, be even better than the already excellent results obtained in this study.

Since this study did use historically based inputs it can be interpreted as a refutation of the random walk hypothesis of stock price behavior which asserts that the past cannot be used as a money making predictor of future price bahavior, although this was not one of the intended purposes of the study.

The return of portfolio Q, which was selected by the model after the best 40 stocks had been removed from the reduced sample of 300, is lower than that of the other computer selected portfolios but still higher than any of the other reference portfolios. This suggests that optimal portfolio size may be in the 20 to 60 issues range and that portfolio return can be expected to decrease with increases in portfolio size, as measured by the number of issues held. Since many institutional

investors hold hundreds of issues in their portfolios it is likely that they could improve their performance simply by reducing the size of their portfolios.

The performance of the 100 mutual funds, which utilize varying but considerable portfolio turnover in an attempt to achieve their goals, is quite interesting since they did not perform significantly differently from the two reference mutual funds which followed the buy and hold policy and were outperformed by the computer selected portfolios which used the buy and hold strategy. This suggests that their considerable portfolio turnover is dysfunctional behavior on their part and that they should expend more effort on proper selection of security issues which can be bought and held for considerable periods of time.

Limitations

When the theory was first proposed by Markowitz in 1952 [3], several important limitations precluded any attempt at practical application of the model. Among these limitations were: lack of suitable computers, programs, and data; lack of time for non-computer calculation of even small portfolio selection problems, which might take several months or even years to solve without a computer; computational cost; and the lack of managerial understanding, acceptance, and support.

During the early 1960's many financial institutions acquired large scale computer systems which are capable of solving problems with the Markowitz model, computer programs for doing so became available, and the COMPUSTAT data base also became available, so these factors are no longer significant limitations.

The major remaining limitations are computational cost (approximately $750 per typical computer run) and the still apparent lack of managerial understanding, acceptance, and support.

Most of the supposed theoretical limitations of the model which have been advanced by investment practitioners simply do not withstand analysis as was shown in Chapter Four and appear to be based on less than adequate understanding of the model and its method of operation. The model is apparently not being used for the wrong reasons!

There are, however, situations for which the model is not appropriate. These include decisions for investors who need to utilize important non-linear constraints which cannot be satisfactorily approximated by linear functions. The model is also not presently appropriate for short term

speculators since computational and transactions costs are likely to be too high and proper input data for their purposes are too difficult to obtain although some firms are now providing daily stock price data on computer ready magnetic tape.

Prospects

Gradual evolution toward an optimal man-machine investment management system can be expected as computers become more versatile and computational costs decline while management scepticism and fear give way to understanding and acceptance.

Computers excel at routine mathematical operations; they are much faster than humans, more accurate, and more reliable. Man excels in the relatively unstructured, non-quantitative aspects of decision making. It is to be expected that the optimal man-machine relationship will change over time toward this kind of partnership: computers for quantitative decision areas, humans for qualitative aspects -- each will do what he can do best and complement the other.

After an efficient set has been selected and in the interim before new information makes recalculation necessary, new funds inflows might be handled by a Total Investment Management System (TIMS).

Such a system is already feasible in the present state of the art and could operate in the following manner: The Markowitz model would be used with a large scale, third generation, time sharing computer which would be connected electronically through investment banking firms' computers to stock markets. It would receive input information on new funds inflows and current stock price data from a quotation system (such as Stockmaster) and might have on-line remote input-output devices which could allow human veto over projected transactions (similar to the SAGE system for national defense). The efficient set of securities would be stored in the computer's memory and when it was advised of the receipt

of investible funds it could check the list and the current prices, buy the stock (or stocks) with the lowest price on any market anywhere in the world, notify the firm's broker, transfer the funds, update the portfolio inventory, and prepare a report for the manager of that account, all in a fraction of a second, while also performing, at the same time, routine data processing work for its employer institution.

Although such a system is technically feasible now, it would be costly, and it is not likely to be greeted enthusiastically by present human investment decision makers until they realize that they cannot be replaced by such a system, since it cannot operate without input concerning expected returns on securities and these must be supplied by humans, but are merely receiving the assistance of a sophisticated partner which will relieve them of some drudgery.

Conclusions

The results of the simulation study reported herein indicate that the Markowitz portfolio selection model, even with mechanistic, historical inputs, provides significantly superior performance, in terms of realized holding period returns (capital gains plus dividends) at specified risk levels, than any other selection method tested.

A risk index based upon the Standard and Poor's Stock Rating was tested and found to be an operationally useful risk measure for use with the Markowitz model. Its use will further simplify the practical applicability of the model and reduce the cost of using it.

Since most institutional investors are familiar with the model, and have the necessary computer facilities to use it, it must be assumed that they do not do so, at present, for the "wrong" reasons. The results of this study indicate that they should use it, and, if they do, they can expect to perform better than they have, in the past, without the model.

Important implications of this study include the following: the random walk hypothesis that past price data cannot be used to make "good" selections of securities is refuted since this study obtained superior performance from the model using only historical inputs; optimal portfolio size is less than that most frequently used by most institutional investors; and the buy and hold policy with either equal dollar or equal shares strategies is superior to a policy of frequent portfolio turnover, at least in terms of return for long term investors.

The model does have some limitations, however. It is intended for single point in time decisions and can be used for sequential decision

making at rather widely spaced intervals, such as: annually or perhaps even quarterly; but it is not suitable for daily decision making for short term speculative trading purposes. Also, it is not suitable for use by investors who might need to impose nonlinear constraints on their decision problems.

Gradual evolution toward an optimal man-machine investment management system can be expected in the future as more institutional investors begin to use the model, as this study indicates they should.

References

1. Cohen, K. J. and Pogue, J. A., "An Empirical Evaluation of Alternative Portfolio Selection Models," Journal of Business, April 1967, 166-193.

2. Fisher, L. and Lorie, J. H., "Rates of Return on Investments in Common Stock: The Year by Year Record 1926-1965," Journal of Business, July 1968, 291-316.

3. Markowitz, H. M., "Portfolio Selection," Journal of Finance, March 1952, 77-91.

4. Sharpe, W. F., "A Simplified Model for Portfolio Analysis," Management Science, January 1963, 277-293.

5. Nelson, R. L., The Investment Policies of Foundations, Russell Sage Foundation, 1967.

APPENDIX A

COMPANIES INCLUDED IN BASIC SAMPLE

Abbott Laboratories

Abex Corporation

ACF Industries, Incorporated

Acme Markets, Incorporated

Adams-Millis Corporation

Addressograph-Multigraph

Admiral Corporation

Aerojet-General Corporation

Aeroquip Corporation

Air Products and Chemicals

Air Reduction Company

Alcan Aluminum

Alleghany Airlines, Incorporated

Allegheny Ludlum Steel

Allen Electric and Equipment

Allen Industries, Incorporated

Allied Chemical Corporation

Allied Kid Company

Allied Mills, Incorporated

Allied Products Corporation

Allied Stores

Allis-Chalmers Manufacturing Company

Alpha Portland Cement Company

APPENDIX A (Continued)

Aluminun Company of America

Amalgamated Sugar Company

Amerada Petroleum

American Airlines, Incorporated

American Bakeries Company

American Bank Note Company

American Beverage Corporation

American Bosch Corporation

American Can Company

American Cement Corporation

American Chain and Cable

American Consumer Industries

American Crystal Sugar Company

American Cyanamid Company

American Distilling Company

American Enka Corporation

American Export Isbrandtsen Company

American Home Products

American Investment Company

American Machine and Foundry

American Metal Climax

American Motors Corporation

American News Company

American Potash and Chemical

American Seating Company

American Ship Building Company

American Smelting and Refining Company

APPENDIX A (Continued)

American Standard, Incorporated

American Sugar Company

American Telephone and Telegraph (AT&T)

American Tobacco Company

American Zinc Company

Ametek, Incorporated

Amsted Industries

Anaconda Company

Anchor Hocking Glass Corporation

Anheuser-Busch, Incorporated

Archer-Daniels-Midland Company

Armco Steel Corporation

Armour and Company

Armstrong Cork Company

Armstrong Rubber Company

Arvin Industries, Incorporated

Ashland Oil and Refining Company

Associated Brewing Company

Associated Dry Goods Corporation

Associates Investment Company

Atchinson, Topeka and Santa Fe

Atlantic Richfield Company

Atlas Chemical Industries

Austin Nichols and Company, Incorporated

Avco Corporation

Avis Industrial Corporation

Avon Products, Incorporated

APPENDIX A (Continued)

Babbitt (B. T.), Incorporated

Babcock and Wilcox Company

Baldwin (D. H.) Company

Basic, Incorporated

Bath Industries, Incorporated

Bausch and Lomb, Incorporated

Bayuk Cigars, Incorporated

Beatrice Foods Company

Beech Aircraft Corporation

Beech-Nut Life Savers

Belden Manufacturing Company

Belding Heminway Company

Bell and Howell Company

Bendix Corporation

Beneficial Finance Company

Benrus Watch Company, Incorporated

Beryllium Corporation

Bethlehem Steel Corporation

Black and Decker Manufacturing Company

Blaw-Knox Company

Bliss (E. W.) Company

Bliss and Laughlin Industries

Boeing Company

Bond Stores, Incorporated

Borden Company

Borg-Wagner Corporation

Boston Herald-Traveler Corporation

APPENDIX A (Continued)

Braniff Airways, Incorporated

Briggs and Stratton Corporation

Bristol-Myers Company

British Petroleum (ADR)

Broadway-Hale Stores

Brown Company

Brown-Forman Distillers

Brown Shoe Company, Incorporated

Brown and Sharpe Manufacturing Company

Brunswick Corporation

Bucyrus-Erie Company

Budd Company

Bullard Company

Bulova Watch Company, Incorporated

Bunker Hill Company

Burlington Industries, Incorporated

Burroughs Corporation

Callahan Mining Corporation

Calumet and Hecla, Incorporated

Campbell Red Lake Mines

Canada Dry Corporation

Canadian Breweries

Canteen Corporation

Carborundum Company

Carnation Company

Carpenter Steel Company

Carrier Corporation

APPENDIX A (Continued)

Case (J. I.) Company

Castle (A. M.) and Company

Caterpillar Tractor Company

Celanese Corporation

Cenco Instruments

Central Aguirre Sugar Company

Central Foundry Company

Central Soya Company, Incorporated

Century Electric Company

Cerro Corporation

Cessna Aircraft Company

C F and I Steel Corporation

Chemetron Corporation

Chemway Corporation

Cherry-Burrell Corporation

Chesebrough-Pond's, Incorporated

Chicago Pneumatic Tool

Chris-Craft Industries

Chrysler Corporation

Cincinnati Milling Machine

C-I-T Financial

Cities Service Company

Clark Equipment Company

Cleveland-Cliffs Iron Company

Clevite Corporation

Cluett, Peabody and Company, Incorporated

Coca-Cola Bottling, New York

APPENDIX A (Continued)

Coca-Cola Company

Colgate-Palmolive Company

Collins Aikman Corporation

Collins Radio Company

Colt Industries, Incorporated

Columbia Broadcasting System

Columbia Gas System

Columbia Pictures Corporation

Combustion Engineering

Cominco Limited

Commercial Credit Company

Commercial Solvents Corporation

Conde Nast Publications, Incorporated

Cone Mills Corporation

Congoleum-Nairn, Incorporated

Consolidated Cigar Corporation

Consolidated Edison of New York

Consolidated Foods

Consolidated Laundries Corporation

Container Corporation of America

Continental Air Lines, Incorporated

Continental Baking Company

Continental Can Company

Continental Oil Company

Continental Steel Corporation

Conwood Corporation

Cook Paint and Varnish Company

APPENDIX A (Continued)

Cooper Industries

Cooper Tire and Rubber

Copeland Refrigeration

Copper Range Company

Copperweld Steel Company

Corn Products Company

Corning Glass Works

Crane Company

Crompton and Knowles Corporation

Crowell-Collier and Macmillan

Crown Cork and Seal Company, Incorporated

Crown Zellerbach Corporation

Crucible Steel Company of America

Cudahy Company

Cummins Engine Company

Cuneo Press, Incorporated

Cunningham Drug Stores

Curtis Publishing Company

Curtiss-Wright Corporation

Cutler-Hammer, Incorporated

Dana Corporation

Dan River Mills, Incorporated

Dayco Corporation

Deere and Company

Del Monte Corporation

Detroit Steel Corporation

De Vilbiss Company

APPENDIX A (Continued)

Diamond International

Diamond Shamrock Corporation

Diana Stores Corporation

Dictaphone Corporation

Diebold, Incorporated

DiGeorgio Corporation

Disney (Walt) Productions

Distillers Corporation - Seagrams Limited

Dome Mines, Limited

Dominion Stores, Limited

Domtar, Limited

Dow Chemical

Dresser Industries

Drexel Enterprises, Incorporated

Dr. Pepper Company

DuPont (E. I.) de Nemours

Duval Corporation

Duquesne Brewing of Pittsburgh

DWG Corporation

Eagle-Picher Industries

Eastern Air Lines

Eastman Kodak Company

Eaton Yale and Towne

Edison Brothers Stores, Incorporated

Electrolux Corporation

Elgin National Watch Company

Emerson Electric Company

APPENDIX A (Continued)

Emery Air Freight Corporation

Emhart Corporation

Endicott Johnson Corporation

ESB, Incorporated

Ethyl Corporation

Evans Products Company

Eversharp, Incorporated

Ex-Cell-O Corporation

Factor, Max and Company

Fafnir Bearing Company

Fairchild Camera and Instrument

Fairmont Foods Company

Falstaff Brewing Corporation

Family Finance Corporation

Fansteel Metallurgical Corporation

Fedders Corporation

Federal-Mogul Corporation

Federated Department Stores

Ferro Corporation

Firestone Tire and Rubber Company

First National Stores

Flintkote Company

FMC Corporation

Food Fair Stores, Incorporated

Foote Mineral Company

Foster Wheeler Corporation

Franklin Stores Corporation

APPENDIX A (Continued)

Freeport Sulphur Company

Fruehauf Corporation

Gamble Skogmo, Incorporated

Gardner-Denver Company

Gar Wood Industries, Incorporated

General Acceptance Corporation

General American Transportation Corporation

General Aniline and Film Corporation (GAF)

General Cable Corporation

General Cigar Company, Incorporated

General Electric Company

General Finance Corporation

General Foods Corporation

General Hosts Company

General Instrument Corporation

General Mills, Incorporated

General Motors

General Plywood Corporation

General Portland Cement

General Precision Equipment

General Refractories Company

General Signal Corporation

General Telephone and Electronics

General Time Corporation

General Tire and Rubber

Genesco, Incorporated

Georgia-Pacific Corporation

APPENDIX A (Continued)

Gerber Products Company

Giant Portland Cement Company

Giant Yellownife Mines

Gillette Company

Gimbel Brothers, Incorporated

Globe Union, Incorporated

Goodrich (B. F.) Company

Goodyear Tire and Rubber

Gould-National Batteries

Grand Union Company

Granite City Steel Company

Graniteville Company

Grant (W. T.) Company

Great Atlantic and Pacific Tea Company, Incorporated

Great Northern Paper Company

Great Western Sugar Company

Green Giant Company

Greyhound Corporation

Grinnell Corporation

Grumman Aircraft Engineering

Gulf and Western Industries

Gulf Oil Corporation

Hall (W. F.) Printing Company

Halliburton Company

Hamilton Watch Company

Hammermill Paper Company

Hammond Organ Company

APPENDIX A (Continued)

Hart Schaffner and Marx

Hat Corporation of America

Hazeltine Corporation

Heileman (G.) Brewing Company

Heinz (H. J.) Company

Helena Rubinstein, Incorporated

Heller (Walter E.) Company

Helme Products

Hercules, Incorporated

Hershey Chocolate Corporation

Hilton Hotels Corporation

Holly Sugar Corporation

Homestake Mining Company

Honeywell, Incorporated

Hooker Chemical Corporation

Hoover Ball Bearing Company

Hoover Company

Hormel (Geo A.) and Company

Host International, Incorporated

Household Finance Corporation

Howmet Corporation

Hudson Bay Mining and Smelting

Ideal Cement Company

Imperial Oil, Limited

Indian Head, Incorporated

Industrial Acceptance

Ingersoll-Rand Company

APPENDIX A (Continued)

Inland Steel Company

Inspiration Consolidated Copper

Insurance Company of North America

Interchemical Corporation

Interco, Incorporated

Interlake Steel Corporation

International Business Machines (IBM)

International Harvester

International Minerals and Chemical

International Nickel Company of Canada

International Paper

International Salt Company

International Silver Company

International Telephone and Telegraph

Interstate Bakeries Corporation

Interstate Department Stores

Interstate Motor Freight System

Island Creek Coal Company

I-T-E Circuit Breaker Company

Jaeger Machine Company

Jewel Companies, Incorporated

Johns-Manville Corporation

Johnson and Johnson

Johnson Service Company

Jones and Laughlin Steel

Joy Manufacturing

Kaiser Aluminum and Chemical

APPENDIX A (Continued)

Kaiser Cement and Gypsum

Keebler Company

Kellogg Company (Battle Creek)

Kelsey-Hayes Company

Kendall Company

Kennametal, Incorporated

Kennecott Copper Corporation

Kerr-McGee Corporation

Keystone Steel Wire Company

Kimberly-Clark Corporation

King-Seeley Thermos

Koering Company

Koppers Company, Incorporated

Kresge (S. S.) Company

Kroger Company

Lane Bryant, Incorporated

Leesona Corporation

Lehigh Portland Cement Company

Libbey-Owens-Ford Glass

Libby, McNeill and Libby

Liggett and Myers Tobacco

Lily-Tulip Cup Corporation

Lockheed Aircraft

Lone Star Brewing Company

Lone Star Cement Corporation

Lorillard (P.) Company

Lowenstein (M.) and Sons

APPENDIX A (Continued)

Lucky Stores, Incorporated

Lukens Steel Company

MacAndrews and Forbes Company

Macy (R. H.) and Company

Magma Copper Company

Magnavox Company

Manhattan Shirt Company

Mallory (P. R.) and Company

Mansfield Tire and Rubber

Marathon Oil Company

Marquette Cement Manufacturing

Marshall Field and Compagny

Masonite Corporation

Massey-Fergusson, Limited

May Department Stores Company

Mayer (Oscar) and Company

Maytag Company

McCall Corporation

McCrory Corporation

McDonnell Douglas

McGraw-Edison Company

McGraw-Hill, Incorporated

McIntyre Porcupine Mines

McLouth Steel Corporation

Mead Corporation (The)

Mead Johnson and Company

Medusa Portland Cement

APPENDIX A (Continued)

Melville Shoe Corporation

Mercantile Stores Company, Incorporated

Merck and Company

Meredith Corporation

Merritt-Chapman and Scott

Mesta Machine Company

Midland-Ross Corporation

Minnesota Mining and Manufacturing

Missouri Portland Cement

Mobil Oil Corporation

Mohawk Rubber Company

Moore Corporation, Limited

Moore and McCormack Company

Molybdenum Corporation of America

Monarch Machine Tool Company

Monsanto Company

Montgomery Ward and Company

Morrell (John) and Company

Morrison-Knudsen Company

Motorola, Incorporated

Munsingwear, Incorporated

Murphy (G. C.) Company

Murphy (G. W.) Industries, Incorporated

Nalco Chemical Company

National Acme Company

National Airlines, Incorporated

National Biscuit Company

APPENDIX A (Continued)

National Cash Register

National Dairy Products

National Distillers and Chemical

National Gypsum Company

National Lead Company

National-Standard Company

National Steel Corporation

National Tea Company

National Union Electric

National Sugar Refining Company

Neisner Brothers, Incorporated

Neptune Meter Company

Newberry (J. J.) Company

Newport News Shipbuilding and Dry Dock

New York Shipbuilding

North American Car Corporation

North American Corporation

Northrop Corporation

Northwest Airlines, Incorporated

Norwich Pharmacal Company

Ohio Brass Company

Olympia Brewing Company

Otis Elevator Company

Outboard Marine

Owens-Illinois, Incorporated

Pabst Brewing Company

Pacific Gas and Electric

APPENDIX A (Continued)

Pacific Intermountain Express

Packard-Bell Electronics

Pan American World Airways

Parke, Davis and Company

Parker-Hannifin Corporation

Penn-Dixie Cement Corporation

Penney (J. C.) Company

Pennsalt Chemicals Corporation

Pennsylvania Railroad Company

Pepsico, Incorporated

Pet, Incorporated

Pfizer (Charles) and Company, Incorporated

Phelps Dodge

Philip Morris, Incorporated

Phillips Petroleum

Phillips-Van Heusen Corporation

Pillsbury Company

Piper Aircraft Corporation

Pitney-Bowes, Incorporated

Pittsburgh Brewing Company

Pittsburgh Plate Glass Company

Pittsburgh Steel Company

Pittston Company

Plough, Incorporated

Polaroid Corporation

Potlatch Forests

Pratt and Lambert, Incorporated

APPENDIX A (Continued)

Prentice-Hall, Incorporated

Procter and Gamble Company

Publickers Industries, Incorporated

Pullman, Incorporated

Purex Corporation, Limited

Purolator Products, Incorporated

Quaker Oats Company

Quaker State Oil Refining Company

Radio Corporation of America

Ralston Purina Company

Rath Packing Company

Raymond International, Incorporated

Rayonier, Incorporated

Raytheon Company

Red Owl Stores

Reeves Brothers, Incorporated

Reliance Electric and Engineering

Republic Steel Corporation

Revere Copper and Brass, Incorporated

Rex Chainbelt, Incorporated

Rexall Drug and Chemical

Reynolds Metals Company

Reynolds (R. J.) Tobacco

Richardson-Merrell, Incorporated

Riegel Paper Corporation

Robertshaw Controls

Robertson (H. H.) Company

APPENDIX A (Continued)

Rockwell Manufacturing Company

Rohm and Haas Company

Rohr Corporation

Ronson Corporation

Royal Crown Cola Company

Safeway Stores, Incorporated

St. Joseph Lead

St. Regis Paper Company

Sangamo Electric Company

Schenley Industries, Incorporated

SCM Corporation

Scott Paper Company

Scovill Manufacturing Company

Seaboard Finance Company

Searle (G. D.) and Company

Sears, Roebuck and Company

Seeman Brothers, Incorporated

Sharon Steel Corporation

Shattuck (Frank G.) Company

Shell Oil Company

Sheraton Corporation of America

Sherwin Williams Company

Shoe Corporation of America

Signal Oil and Gas Company

Signode Corporation

Simmons Corporation

Simplicity Pattern Company

APPENDIX A (Continued)

Sinclair Oil Corporation

Singer Company

Skelly Oil Company

Skil Corporation

Smith Kline and French Laboratories

Spalding (A. G.) and Brothers, Incorporated

Sprague Electric Company

Square D Company

Staley (A. E.) Manufacturing Company

Standard Brands, Incorporated

Standard Oil Company (Indiana)

Standard Oil Company (New Jersey)

Standard Oil Company (Ohio)

Standard Oil Company of California

Standard Packaging Corporation

Standard Products Company

Stanley Works (The)

Starret (L. S.) Company

Steel Company of Canada

Steep Rock Iron Mines, Limited

Sterling Drug, Incorporated

Stevens (J. P.) and Company, Incorporated

Stewart-Warner

Stokely-Van Camp, Incorporated

Stone Container Corporation

Stop and Shop, Incorporated

Suburban Propane Gas Corporation

APPENDIX A (Continued)

SuCrest Corporation

Sunbeam Corporation

Sun Chemical Corporation

Sun Oil Company

Sundstrand Corporation

Sunray DX Oil Company

Superior Oil Company

Swift and Company

Symington Wayne Corporation

Talcott (James), Incorporated

Tampax, Incorporated

Tecumseh Products

Texaco, Incorporated

Texas Gulf Sulphur Company

Textron, Incorporated

Thiokol Chemical Corporation

Thrifty Drug Stores Company

Time, Incorporated

Times Mirror Company

Timken Roller Bearing Company

Trane Company

Trans World Airlines

Todd Shipyards Corporation

Tootsie Roll Industries

Torrington Company

TRW, Incorporated

Uarco, Incorporated

APPENDIX A (Continued)

UMC Industries

Union Camp Corporation

Union Carbide Corporation

Union Electric Company

Union Oil Company of California

Union Pacific Railroad

Union Tank Car Company

Uniroyal, Incorporated

United Aircraft Corporation

United Air Lines, Incorporated

United Merchants and Manufacturers

United Shoe Machinery

U. S. Freight Company

U. S. Gypsum Company

U. S. Lines Company

U. S. Pipe and Foundry

U. S. Playing Card Company

U. S. Plywood-Champion Papers, Incorporated

U. S. Smelting Refining and Manufacturing

U. S. Steel Corporation

U. S. Sugar Corporation

U. S. Tobacco Company

Universal Leaf Tobacco

Van Raalte Company, Incorporated

Walgreen Company

Walker (Hiram)-Gooderham and Worts

Wallace-Murray Corporation

APPENDIX A (Continued)

Walworth Company

Ward Foods

Warner and Swasey Company

Waukesha Motor Company

Western Air Lines, Incorporated

Western Union Telegraph

Westinghouse Air Brake

Westinghouse Electric Corporation

West Point-Pepperell

West Virginia Pulp and Paper Company

Weyerhaeuser Company

Wheeling Steel Corporation

White Motors Corporation

Wickes, Incorporated

Winn-Dixie Stores, Incorporated

Woodward Iron Company

Woolworth (F. W.)

Wrigley (William Jr.) Company

Xerox Corporation

Youngstown Sheet and Tube

Zenith Radio Corporation

APPENDIX B

COMPANIES INCLUDED IN REDUCED SAMPLE

ACF Industries, Incorporated

Adams-Millis Corporation

Admiral Corporation

Alleghany Airlines, Incorporated

Allen Electric and Equipment

Allen Industries, Incorporated

Amalgamated Sugar Company

American Airlines, Incorporated

American Beverage Corporation

American Bosch Arma Corporation

American Can Company

American Crystal Sugar Company

American Distilling Company

American Enka Corporation

American Home Products

American Investment Company

American Machine and Foundry

American Motors Corporation

American News Company

American Ship Building Company

American Zinc Company

Ametek, Incorporated

Anheuser-Busch, Incorporated

APPENDIX B (Continued)

Armco Steel Corporation

Armour and Company

Armstrong Cork Company

Ashland Oil and Refining Company

Associated Brewing Company

Associated Dry Goods Corporation

Austin Nichols and Company, Incorporated

Avco Corporation

Avis Industrial Corporation

Avon Products, Incorporated

Babbitt (B. T.), Incorporated

Baldwin (D. H.) Company

Basic, Incorporated

Bayuk Cigars, Incorporated

Beech Aircraft Corporation

Beech-Nut Life Savers

Belden Manufacturing Company

Belding Heminway Company

Beneficial Finance Company

Benrus Watch Company, Incorporated

Beryllium Corporation

Black and Decker Manufacturing Company

Bliss (E. W.) Company

Boeing Company

Braniff Airways, Incorporated

Briggs and Stratton Corporation

Bristol-Myers Company

APPENDIX B (Continued)

British Petroleum (ADR)

Brown Company

Brown-Forman Distillers

Brown and Sharpe Manufacturing Company

Brunswick Corporation

Bucyrus-Erie Company

Bullard Company

Bulova Watch Company, Incorporated

Bunker Hill Company

Burlington Industries, Incorporated

Callahan Mining Corporation

Calumet and Hecla, Incorporated

Campbell Red Lake Mines

Canadian Breweries

Canteen Corporation

Carpenter Steel Company

Caterpillar Tractor Company

Celanese Corporation

Cenco Instruments

Central Foundry Company

Central Soya Company, Incorporated

Century Electric Company

Cessna Aircraft Company

C F and I Steel Corporation

Chemway Corporation

Cherry-Burrell Corporation

Chesebrough-Pond's, Incorporated

APPENDIX B (Continued)

Chris-Craft Industries

Clark Equipment Company

Cluett, Peabody and Company, Incorporated

Coca-Cola Bottling, New York

Colgate-Palmolive Company

Collins Aikman Corporation

Collins Radio Company

Colt Industries, Incorporated

Columbia Broadcasting System

Columbia Pictures Corporation

Commercial Solvents Corporation

Conde Nast Publications, Incorporated

Cone Mills Corporation

Congoleum-Nairn, Incorporated

Consolidated Cigar Corporation

Consolidated Foods

Consolidated Laundries Corporation

Continental Air Lines, Incorporated

Continental Steel Corporation

Cook Paint and Varnish Company

Cooper Industries

Cooper Tire and Rubber

Copeland Refrigeration

Copperweld Steel Company

Crane Company

Crompton and Knowles Corporation

Crowell-Collier and Macmillan

APPENDIX B (Continued)

Crown Cork and Seal Company, Incorporated

Crown Zellerbach Corporation

Cudahy Company

Cummins Engine Company

Cuneo Press, Incorporated

Curtis Publishing Company

Dan River Mills, Incorporated

Del Monte Corporation

Detroit Steel Corporation

De Vilbiss Company

Diana Stores Corporation

Diebold, Incorporated

DiGeorgio Corporation

Disney (Walt) Productions

Dominion Stores, Limited

Domtar, Limited

Drexel Enterprises, Incorporated

Dr. Pepper Company

Duquesne Brewing of Pittsburgh

Eaton Yale and Towne

Edison Brothers Stores, Incorporated

Electrolux Corporation

Elgin National Watch Company

Emerson Electric Company

Emery Air Freight Corporation

Emhart Corporation

ESB, Incorporated

APPENDIX B (Continued)

Ethyl Corporation

Evans Products Company

Eversharp, Incorporated

Ex-Cell-O Corporation

Factor, Max and Company

Fairchild Camera and Instrument

Fairmont Foods Company

Falstaff Brewing Corporation

Family Finance Corporation

Ferro Corporation

FMC Corporation

Foster Wheeler Corporation

Franklin Stores Corporation

Fruehauf Corporation

Gamble Skogmo, Incorporated

Gar Wood Industries, Incorporated

General Acceptance Corporation

General Aniline and Film Corporation (GAF)

General Cable Corporation

General Finance Corporation

General Hosts Company

General Instrument Corporation

General Mills, Incorporated

General Plywood Corporation

General Time Corporation

General Tire and Rubber

Georgia-Pacific Corporation

APPENDIX B (Continued)

Gerber Products Company

Giant Portland Cement Company

Giant Yellowknife Mines

Gimbel Brothers, Incorporated

Graniteville Company

Grant (W. T.) Company

Green Giant Company

Greyhound Corporation

Grumman Aircraft Engineering

Gulf and Western Industries

Hamilton Watch Company

Hammermill Paper Company

Hart Schaffner and Marx

Hat Corporation of America

Hazeltine Corporation

Heller (Walter E.) Company

Hershey Chocolate Corporation

Holly Sugar Corporation

Hoover Ball Bearing Company

Hoover Company

Host International, Incorporated

Household Finance Corporation

Howmet Corporation

Indian Head, Incorporated

Industrial Acceptance

Interchemical Corporation

International Minerals and Chemical

APPENDIX B (Continued)

International Silver Company

Interstate Department Stores

Interstate Motor Freight System

Johnson and Johnson

Kellogg Company (Battle Creek)

Kendall Company

Kennametal, Incorporated

King-Seeley Thermos

Lane Bryant, Incorporated

Leesona Corporation

Libby, McNeill and Libby

Lockheed Aircraft

Lone Star Brewing Company

Lucky Stores, Incorporated

MacAndrews and Forbes Company

Macy (R. H.) and Company

Magma Copper Company

Magnavox Company

Manhattan Shirt Company

Mansfield Tire and Rubber

Massey-Fergusson, Limited

Mayer (Oscar) and Company

Maytag Company

McCall Corporation

McCrory Corporation

McGraw-Hill, Incorporated

Merck and Company

APPENDIX B (Continued)

Midland-Ross Corporation

Mohawk Rubber Company

Monarch Machine Tool Company

Morrell (John) and Company

Munsingwear, Incorporated

Nalco Chemical Company

National Airlines, Incorporated

National-Standard Company

National Union Electric

Neisner Brothers, Incorporated

New York Shipbuilding

North American Car Corporation

Northrop Corporation

Northwest Airlines, Incorporated

Norwich Pharmacal Company

Olympia Brewing Company

Pabst Brewing Company

Pacific Intermountain Express

Packard-Bell Electronics

Pan American World Airways

Parker-Hannifin Corporation

PepsiCo, Incorporated

Pet, Incorporated

Phillips-Van Heusen Corporation

Pillsbury Company

Piper Aircraft Corporation

Pittsburgh Brewing Company

APPENDIX B (Continued)

Pittsburgh Steel Company

Plough, Incorporated

Prentice-Hall, Incorporated

Publickers Industries, Incorporated

Purex Corporation, Limited

Purolator Products, Incorporated

Quaker State Oil Refining Company

Radio Corporation of America

Ralston Purina Company

Raytheon Company

Reeves Brothers, Incorporated

Revere Copper and Brass, Incorporated

Rexall Drug and Chemical

Riegel Paper Corporation

Rohr Corporation

Ronson Corporation

Royal Crown Cola Company

Seaboard Finance Company

Seeman Brothers, Incorporated

Shattuck (Frank G.) Company

Sheraton Corporation of America

Shoe Corporation of America

Signode Corporation

Simplicity Pattern Company

Skil Corporation

Spalding (A. G.) and Brothers, Incorporated

Sprague Electric Company

APPENDIX B (Continued)

Square D Company

Standard Brands, Incorporated

Standard Products Company

Starret (L. S.) Company

Sterling Drug, Incorporated

Stokely-Van Camp, Incorporated

Stone Container Corporation

Stop and Shop, Incorporated

SuCrest Corporation

Sun Chemical Corporation

Sundstrand Corporation

Symington Wayne Corporation

Talcott (James), Incorporated

Textron, Incorporated

Thiokol Chemical Corporation

Thrifty Drug Stores Company

Times Mirror Company

Trans World Airlines

Tootsie Roll Industries

UMC Industries

United Air Lines, Incorporated

U. S. Freight Company

Universal Leaf Tobacco

Van Raalte Company, Incorporated

Walgreen Company

Wallace-Murray Corporation

Walworth Company

APPENDIX B (Continued)

Ward Foods

Warner and Swasey Company

Western Air Lines, Incorporated

White Motors Corporation

Wickes, Incorporated

Xerox Corporation

Zenith Radio Corporation

APPENDIX C

Equal Dollar Strategy

In the tables which follow, an initial investment of $100,000 is assumed to be made in equal dollar amounts in each security of each of the seventeen portfolios, A through Q, inclusive, on the first business day of 1956 and liquidated on the last business day of 1965.

The tables indicate the risk class of each portfolio security, the name of the issuing company, the COMPUSTAT industry number, the initial investment, the capital gain from that investment, the dividend income received during the holding period from that investment, and the total return from that investment (capital gain plus dividend income).

Portfolio totals indicate the total initial investment, the total capital gain, the total dividend income received during the holding period, and the total (holding period) return.

TABLE 16

PORTFOLIO A 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
1	Avon Products	2844	5,000	175,000	10,025	185,025
4	Brown Forman	2085	5,000	67,500	4,700	72,200
4	Cenco Instruments	3811	5,000	87,500	4,975	92,475
8	Crown Cork & Seal	3221	5,000	62,500	6,250	68,750
3	Diebold	3570	5,000	70,000	5,225	75,225
4	Emerson Electric	3610	5,000	51,000	5,790	56,790
4	Emery Airfreight	4511	5,001	108,355	5,790	114,840
8	Ethyl	2899	5,000	180,000	6,150	186,150
3	Factor, Max	2844	5,001	53,344	6,135	59,479
4	Fairchild Camera	3670	4,998	78,302	1,949	80,251
8	Gulf & Western Industries	9998	5,000	67,500	300	67,800
3	Hart Schaffner & Marx	2300	5,001	60,012	5,801	65,813
4	Lukens Steel	3310	5,000	48,000	5,720	53,720
1	Magnavox	3651	5,000	97,500	6,200	103,700
5	Northwest Airlines	4511	5,000	59,000	2,350	61,350
4	Polaroid	3861	5,001	190,038	934	190,972

TABLE 16 (Continued)

PORTFOLIO A 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Tampax	2600	5,000	51,500	5,470	56,970
2	Thrifty Drug Stores	5331	5,000	47,500	9,450	56,950
2	Xerox	3570	4,998	331,534	2,582	334,116
1	Zenith	3651	5,000	71,250	6,388	77,638
	Total:		100,000	1,957,335	102,879	2,060,214

TABLE 17

PORTFOLIO B 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Associated Brewing	2082	4,995	-999	167	-832
4	Bath Industries	3731	5,005	-3,640	1,031	-2,609
3	Borg Warner	3714	4,998	-2,023	1,384	-639
6	Babbit (B. T.)	2899	4,998	-1,666	750	-916
7	C F & I Steel	3310	4,995	-1,665	697	-968
8	Colt Industries	3560	4,982	-2,544	95	-2,449
7	Cudahy	2010	5,000	-625	0	-625
6	Elgin National Watch	3871	4,998	-2,058	412	-1,646
5	Foote Mineral	1000	4,992	-2,048	498	-1,550
8	Hazeltine	3670	4,998	-3,094	1,557	-1,5537
2	International Salt	2800	5,047	-3,136	1,219	-1,917
6	Neisner Brothers	5331	4,998	-2,352	1,514	-838
5	Penn-Dixie Cement	3241	4,992	-3,120	1,903	-1,217
7	Pittsburgh Steel	3310	5,018	-1,930	371	-1,559
4	Potlatch Forests	0800	4,995	-1,887	1,007	-880
6	Rath Packing	2010	4,991	-2,831	1,165	-1,656

TABLE 17 (Continued)

PORTFOLIO B 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
6	Steep Rock Iron Mines	1000	4,998	-3,224	262	-2,972
2	Skelly Oil	1311	5,040	-1,440	760	-680
3	Sprague Electric	3679	4,968	-2,268	635	-1,633
4	Swift	2010	4,992	-2,184	1,130	-1,054
	Total:		100,000	-44,734	16,557	-28,177

TABLE 18

PORTFOLIO C 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	Allied Chemical	2800	3,618	-469	1,075	606
4	American Can	3221	3,572	684	1,520	2,204
5	American Radiator	3430	3,565	-310	1,395	1,085
1	American Telephone & Telegraph	4811	3,600	3,720	2,569	6,289
2	American Tobacco	2111	3,560	3,382	2,496	5,878
3	Atchinson Topeka Santa Fe	4011	3,550	426	2,166	2,592
1	Borden	2020	2,570	6,188	1,930	8,118
3	Columbia Gas System	4924	3,564	1,584	2,142	3,726
3	Consolidated Edison N. Y.	4911	3,565	1,395	2,280	3,675
1	DuPont	2800	3,696	128	1,100	1,228
1	Eastman Kodak	2800	3,564	19,602	1,970	21,572
1	General Electric	3600	3,596	3,720	1,593	5,313
4	International Harvester	3522	3,564	5,544	2,303	7,847
1	National Biscuit	2052	3,553	6,545	2,519	9,064
1	Otis Elevator	3550	3,553	7,106	2,668	9,774
2	Pacific Gas & Electric	4911	3,568	4,460	2,069	6,529

TABLE 18 (Continued)

PORTFOLIO C 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income($)	Total Return ($)
6	Pennsylvania Railroad	4011	3,570	5,440	1,326	6,766
1	Procter & Gamble	2841	3,550	6,248	1,828	8,076
1	Sears, Roebuck	5322	3,564	9,504	1,533	11,037
2	Mobil Oil	2913	3,563	3,014	1,636	4,650
1	Standard Oil of California	2913	3,549	6,067	1,563	7,630
1	Standard Oil of New Jersey	2913	3,570	2,030	1,736	3,766
2	Union Carbide	2800	3,576	910	1,169	2,179
2	Union Electric	4911	3,570	3,060	2,083	5,143
2	Union Pacific Railroad	4011	3,556	1,270	2,096	3,366
4	United States Steel	3310	3,538	-366	1,607	1,241
4	Westinghouse Electric	3600	3,570	3,808	1,345	5,153
3	Woolworth	5331	3,568	3,568	1,938	5,506
	Total:		100,000	108,258	51,655	159,913

TABLE 19

PORTFOLIO D 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	Allied Chemical	2800	3,348	-434	994	560
4	Alcoa	3334	3,344	-418	464	46
4	American Can	3221	3,337	639	1,420	2,059
1	American Telephone & Telegraph	4811	3,360	3,472	2,398	5,870
2	American Tobacco	2111	3,340	3,173	2,341	5,514
5	Anaconda	3331	3,337	-1,457	811	-646
4	Bethlehem Steel	3310	3,321	-81	1,686	1,605
4	Chrysler	3711	3,318	5,056	909	5,965
1	DuPont	2800	3,465	120	1,031	1,151
1	Eastman Kodak	2800	3,330	18,315	1,841	20,156
1	General Electric	3600	3,306	3,420	1,465	4,885
1	General Foods	2000	3,336	8,201	2,120	10,321
2	General Motors	3711	3,312	4,176	2,102	6,278
2	Goodyear	3000	3,325	5,075	1,566	6,641
4	International Harvester	3522	3,330	5,180	2,052	7,332
3	International Nickel	1000	3,321	3,969	1,372	5,341

TABLE 19 (Continued)

PORTFOLIO D 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	International Paper	2600	3,328	-104	1,028	924
2	Johns Manville	2950	3,300	825	1,523	2,348
2	Owens Illinois Glass	3221	3,332	2,842	1,235	4,077
1	Procter & Gamble	2841	3,325	5,852	1,712	7,564
1	Sears, Roebuck	5322	3,330	8,880	1,432	10,312
1	Standard Oil of California	2913	3,354	3,182	1,477	4,659
1	Standard Oil of New Jersey	2913	3,366	1,914	1,637	3,551
4	Swift	2010	3,312	-1,449	750	-699
1	Texaco	2913	3,321	6,519	1,916	8,435
2	Union Carbide	2800	3,300	840	1,079	1,919
9	United Aircraft	3721	3,280	3,444	1,241	4,685
4	United States Steel	3310	3,364	-348	1,528	1,180
4	Westinghouse Electric	3600	3,330	3,552	1,254	4,806
3	Woolworth	5331	3,328	3,328	1,808	5,136
	Total:		100,000	97,683	44,292	141,975

TABLE 20

PORTFOLIO E 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	Air Reduction	2800	4,000	-300	1,309	1,009
4	Alcoa	3334	4,048	-506	561	55
3	Allied Chemical	2800	3,996	-518	1,187	669
1	American Telephone & Telegraph	4811	3,990	4,123	2,848	6,971
2	American Tobacco	2111	4,000	3,800	2,804	6,604
4	Bethlehem Steel	3310	3,977	-97	2,019	1,922
2	Caterpillar Tractor	3531	4,000	16,000	2,164	18,164
4	Chrysler	3711	3,990	6,080	1,093	7,173
1	DuPont	2800	4,158	144	1,238	1,382
1	Eastman Kodak	2800	4,014	22,077	2,219	24,296
1	General Electric	3600	4,002	4,140	1,773	5,913
2	General Motors	3711	4,002	5,046	2,540	7,586
3	Goodrich	3000	3,915	-1,350	990	-360
3	Ingersoll Rand	3560	3.990	2,280	2,252	4,532
4	International Harvester	3522	3,996	6,216	2,582	8,798
3	International Nickel	1000	3,977	4,753	1,905	6,658

TABLE 20 (Continued)

PORTFOLIO E 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Johns Manville	2950	3,960	990	1,827	2,817
4	Kennecott Copper	3331	3,978	204	1,836	2,040
8	McDonnell Douglas	3721	4,000	40,000	3,020	43,020
2	Penney	5311	4,026	3,904	1,810	5,714
1	Sears, Roebuck	5322	3,996	10,656	1,718	12,374
1	Standard Oil of New Jersey	2913	3,978	2,262	1,934	4,196
2	Union Carbide	2800	4,015	1,022	1,313	2,335
4	United States Steel	3310	4,002	-414	1,818	1,404
4	Westinghouse Electric	3600	3,990	4,256	1,503	5,759
	Total:		100,000	134,768	46,263	181,031

TABLE 21

PORTFOLIO F 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	Air Reduction	2800	2,520	-189	825	636
4	Alcoa	3334	2,464	-308	342	34
4	American Smelting & Refining	1000	2,500	4,700	1,378	6,078
1	American Telephone & Telegraph	4811	2,490	2,573	1,777	4,350
[illegible]	Caterpillar Tractor	3531	2,500	10,000	1,353	11,353
4	Chrysler	3711	2,520	3,840	690	4,530
4	Continental Can	3221	2,494	1,118	1,075	2,193
2	Continental Oil	2912	2,500	3,550	899	1,949
1	Corn Products	2046	2,505	4,843	2,034	6,877
[illegible]	Dow Chemical	2800	2,475	990	627	1,617
1	DuPont	2800	2,541	88	756	844
1	Eastman Kodak	2800	2,484	13,662	1,373	15,035
1	General Electric	3600	2,542	2,640	1,131	3,771
2	General Motors	3711	2,484	3,132	1,593	4,725
3	Ingersoll Rand	3560	2,485	1,420	1,402	2,822
2	Inland Steel	3310	2,492	1,513	1,446	2,959

TABLE 21 (Continued)

PORTFOLIO F 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Insurance Company of No. America	6333	2,491	1,961	760	2,721
1	International Business Machines	3570	2,485	20,590	1,081	21,671
4	International Harvester	3522	2,466	3,836	1,593	5,429
3	International Nickel	1000	2,501	2,989	1,198	4,187
4	Kennecott Copper	3331	2,496	128	1,152	1,280
4	Liggett & Myers	2111	2,553	74	1,878	1,952
2	Monsanto Chemical	2800	2,496	2,752	704	3,456
2	Owens Illinois Glass	3221	2,516	2,146	932	3,078
2	Parke-Davis	2830	2,492	3,560	1,894	5,454
1	Procter & Gamble	2841	2,500	4,400	1,287	5,687
4	Pullman	3740	2,616	1,360	1,306	2,666
3	Radio Corporation of America	3600	2,496	6,336	789	7,125
1	Reynolds (R. J.)	2111	2,496	5,952	2,513	8,465
1	Sears, Roebuck	5322	2,502	6,672	1,076	7,748
1	Standard Oil of New Jersey	2913	2,499	1,421	1,215	2,636
1	Texaco	2913	2,511	4,929	1,449	6,378

TABLE 21 (Continued)

PORTFOLIO F 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Union Carbide	2800	2,530	644	827	1,471
2	Union Pacific Railroad	4011	2,492	890	1,469	2,359
8	United Aircraft	3721	2,480	2,604	939	3,543
3	United States Gypsum	2950	2,496	117	1,154	1,271
3	United States Rubber	3000	2,500	1,300	1,057	2,357
4	United States Steel	3310	2,494	-258	1,133	875
4	Westinghouse Electric	3600	2,490	2,656	938	3,594
3	Woolworth	5331	2,496	2,496	1,356	3,852
	Total:		100,000	130,627	48,401	179,028

TABLE 22

PORTFOLIO G 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Admiral	3651	4,994	9,988	227	10,215
5	Allis Chalmers	3522	4,998	0	1,699	1,699
4	American Airlines	4511	4,992	1,456	1,186	2,642
6	Callahan Mining	9998	5,000	4,000	0	4,000
5	Fedders	3430	5,010	4,008	4,674	8,682
5	Franklin Stores	5311	4,994	-908	1,866	958
8	General Acceptance	6140	4,998	2,499	3,509	6,008
5	Giant Yellownife Mines	1042	4,998	5,831	4,631	10,462
2	Grinnell	3430	4,992	11,776	2,062	13,838
2	H. J. Heinz	2030	5,016	6,600	2,358	8,958
8	Industrial Acceptance	6140	4,992	3,072	3,360	6,342
2	International Salt	2800	5,047	-3,136	1,219	-1,917
6	I T E Circuit Breaker	3610	4,992	10,368	2,150	12,518
2	Lane Bryant	5600	4,998	14,280	3,756	18,036
2	Monsanto	2800	4,992	5,504	1,408	6,912
8	National Airlines	4511	4,995	14,430	583	15,013

TABLE 22 (Continued)

PORTFOLIO G 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Pabst Brewing	2082	5,000	15,000	1,345	16,345
3	Prentice-Hall	2700	5,000	42,500	3,775	46,275
2	Quaker Oats	2000	4,980	1,328	1,731	3,059
4	Waukesha Motor	3560	5,012	2,685	3,598	6,283
	Total:		100,000	151,281	45,137	196,418

TABLE 23

PORTFOLIO H 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Abbott Laboratories	2830	5,012	12,172	2,445	14,617
2	Addressograph Mimeograph	3570	4,986	11,357	2,321	13,678
3	Air Products & Chemicals	2800	5,000	33,000	910	33,910
5	Allied Products	3449	4,998	5,292	1,238	6,530
1	Avon Products	2844	5,000	175,000	10,025	185,025
3	British Petroleum	2913	5,000	3,000	2,070	5,070
4	Burroughs	3570	4,991	3,059	1,610	4,669
4	Cenco Instruments	3811	5,000	34,500	1,990	36,490
6	Cherry Burrell	3449	4,995	1,332	1,215	2,547
3	Colgate-Palmolive	2841	4,994	7,718	3,232	10,950
4	Evans Products	0800	4,992	10,752	1,213	11,965
3	Hall (W. F.) Printing	2731	4,994	2,497	3,280	5,777
5	Jaeger Machine	3531	4,992	-936	2,708	1,772
4	Kelsey Hayes	3714	4,998	2,058	3,116	5,174
5	Mansfield Tire & Rubber	3000	5,000	1,250	2,563	3,813
4	Murphy (G. W.) Industries	3533	4,997	2,893	1,070	3,963

TABLE 23 (Continued)

PORTFOLIO H 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Potlatch Forests	0800	4,995	-1,887	1,007	-880
2	Simplicity Pattern	2700	5,000	13,000	2,810	15,810
4	United Shoe Machinery	3550	5,046	783	2,501	3,284
4	Westinghouse Air Brake	3740	5,010	1,837	2,196	4,033
	Total:		100,000	318,677	49,520	368,197

TABLE 24

PORTFOLIO I 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Abbott Laboratories	2830	4,998	12,138	2,438	14,576
2	Armstrong Cork	2510	4,995	15,318	3,057	18,375
4	Diamond International	2650	4,986	5,817	2,512	8,329
3	Fafnir Bearing	3569	4,998	6,902	4,084	10,986
3	Hammond	3999	5,004	5,838	5,484	11,322
4	Hoover	3630	5,000	18,750	5,513	24,263
5	Island Creek Coal	1211	5,004	278	2,356	2,636
2	Johns Manville	2950	5,016	1,254	2,314	3,568
4	Massey-Fergusson	3522	5,000	11,500	2,370	13,870
3	Moore	2761	4,998	1,785	921	2,706
8	National Airlines	4511	4,995	14,430	583	15,013
3	National Steel	3310	5,004	3,614	2,409	6,023
4	Purolator Products	3714	4,992	9,984	2,866	12,850
4	Republic Steel	3310	4,998	-612	2,628	2,016
2	Simplicity Pattern	2700	5,000	13,000	2,810	15,810
3	Square D Company	3622	5,000	28,750	5,300	34,050

TABLE 24 (Continued)

PORTFOLIO I 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Stone Container	2650	4,998	15,827	3,215	19,042
2	Sunbeam	3630	4,998	11,172	2,496	13,668
5	United States Pipe & Foundry	3312	5,016	-627	2,508	1,881
3	Wickes	3522	5,000	20,000	3,780	23,780
	Total:		100,000	195,118	59,644	254,762

TABLE 25

PORTFOLIO J 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Amerada Petroleum	1311	4,968	2,916	1,553	4,469
4	American Airlines	4511	5,016	1,463	1,191	2,654
4	American Distilling	2085	5,005	9,555	3,936	13,491
5	Campbell Red Lake Mines	1042	5,005	9,295	2,867	12,162
4	Chrysler	3711	5,019	7,648	1,374	0,022
3	Container Corporation of America	2650	4,997	3,945	2,530	6,475
4	Continental Baking	2051	4,968	-1,656	1,622	-34
6	Duquesne Brewing	2082	5,005	4,004	4,605	8,609
4	Duval	1477	4,970	7,384	1,860	9,244
8	Heller (Walter E.)	6140	5,000	10,000	4,713	14,713
4	Kaiser Aluminum	3334	5,002	-488	1,093	605
5	Keebler	2052	5,010	0	2,096	2,096
1	Kellogg	2000	5,000	15,500	3,440	18,940
4	Koppers	2800	5,010	167	1,817	1,984
5	Montgomery Ward	5322	5,029	-1,391	1,605	214
5	Penn-Dixie Cement	3241	5,024	-3,140	1,915	-1,225

TABLE 25 (Continued)

PORTFOLIO J 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
1	Plough	2830	5,005	27,885	3,403	31,288
3	Rayonier	0300	4,970	142	1,184	1,326
3	Rexall	2800	5,000	52,500	2,688	55,188
2	Rex Chainbelt	3531	4,997	3,945	2,593	6,538
	Total:		100,000	149,674	48,085	197,759

TABLE 26

PORTFOLIO K 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	American Crystal Sugar	2063	4,994	-4,086	3,092	-994
5	American Motors	3711	4,998	9,996	10,879	20,875
4	Amsted Industries	3740	5,019	6,453	3,561	10,014
1	Anchor Hocking Glass	3221	5,016	5,808	3,353	9,161
1	Avon Products	2844	5,000	175,000	10,025	185,025
4	Clevite	3714	4,991	6,293	2,726	9,019
4	De Vilbiss	3550	4,998	13,566	5,226	18,792
6	Duquesne Brewing	2082	5,000	4,000	4,600	8,600
4	Flintkote	2950	4,991	-434	2,671	2,237
3	Goodrich	3000	5,046	-1,740	1,276	-464
2	Grinnell	3430	4,992	11,776	2,062	13,838
4	Interstate Department Stores	5311	5,000	29,000	2,370	31,370
1	Kellogg	2000	5,000	15,500	3,440	18,940
4	Lone Star Brewing	2082	5,000	4,000	3,655	7,655
3	Medusa Portland Cement	3241	4,992	-192	1,930	1,738
5	National Sugar Refining	2062	4,995	-2,295	1,445	-850

TABLE 26 (Continued)

PORTFOLIO K 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Newberry	5331	4,998	-2,058	2,032	-26
4	Purex	2899	4,998	36,652	4,881	41,533
5	St. Joseph Lead	1031	4,980	3,154	1,806	4,960
3	Tecumseh Products	3430	4,992	6,552	3,580	10,132
	Total:		100,000	316,945	74,610	391,555

TABLE 27

PORTFOLIO L 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Admiral	3651	2,497	4,994	114	5,108
7	Alleghany Airlines	4511	2,500	5,625	31	5,656
8	Allen Electric Equipment	3714	2,500	8,750	431	9,181
7	American Beverage	2086	2,500	20,000	0	20,000
4	American Enka	2823	2,497	5,902	1,174	7,076
5	American Motors	3711	2,499	4,998	5,440	10,438
8	Avco	3721	2,502	7,923	2,277	10,200
6	Avis Industrial	3679	2,500	15,000	788	15,788
8	Baldwin (D. H.)	3931	2,504	7,825	1,362	9,187
5	Braniff Airways	4511	2,506	10,382	623	11,005
3	British Petroleum	2913	2,500	1,500	1,035	2,535
4	Brown Forman	2085	2,500	33,750	2,350	36,100
6	Callahan Mining	9998	2,500	2,000	0	2,000
4	Cenco Instruments	3811	2,500	43,750	2,488	46,238
5	Cooper Tire & Rubber	3000	2,499	10,829	2,716	13,545
5	Crompton & Knowles	3550	2,500	9,500	2,260	11,760

TABLE 27 (Continued)

PORTFOLIO L 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Capital	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Crown Cork & Seal	3221	2,500	31,250	31	31,281
4	Electrolux	3631	2,500	13,125	2,388	15,513
8	Ethyl	2899	2,500	90,000	3,075	93,075
8	Green Giant	2030	2,500	13,500	2,070	15,570
8	Grumman Aircraft Engineering	3721	2,502	1,807	773	2,580
8	Gulf & Western Industries	9998	2,500	33,750	600	34,350
5	Hamilton Watch	3871	2,500	2,500	1,230	3,730
6	Hat Corporation of America	2300	2,500	2,500	550	3,050
8	Heller (Walter E.)	6140	2,500	5,000	2,294	7,294
4	Hoover	3630	2,500	9,375	2,756	12,131
4	Host International	5812	2,500	37,500	2,150	40,650
5	Indian Head	2200	2,500	23,750	1,438	25,188
4	International Silver	3999	2,508	1,824	625	2,449
8	Kennametal	3399	2,500	7,000	1,720	8,720
5	Leesona	3550	2,496	9,568	757	10,325
8	McGraw-Hill	2731	2,496	6,864	1,095	7,959

TABLE 27 (Continued)

PORTFOLIO G 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
1	Magnavox	3651	2,500	48,750	3,100	51,850
8	National Airlines	4511	2,493	7,202	235	7,437
5	Northwest Airlines	4511	2,500	29,500	1,175	30,675
5	Pittsburgh Brewing	2082	2,500	8,750	2,663	11,413
7	Publicker	2085	2,502	834	0	834
3	Prentice-Hall	2700	2,500	21,250	1,888	23,138
2	Simplicity Pattern	2700	2,500	6,500	1,405	7,905
2	Xerox	3570	2,499	165,767	1,291	167,058
	Total:		100,000	770,594	59,398	829,992

TABLE 28

PORTFOLIO M 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	3,332	7,497	42	7,539
8	Allen Electric Equipment	3714	3,332	11,662	575	12,237
7	American Beverage	2086	3,333	26,664	0	26,664
4	American Enka	2823	3,333	7,878	1,567	9,445
5	American Motors	3711	3,336	6,672	7,261	13,933
8	Avco	3721	3,330	10,545	3,030	13,575
6	Avis Industrial	3679	3,332	19,992	1,050	21,042
8	Baldwin (D. H.)	3931	3,336	10,425	1,814	12,239
3	British Petroleum	2913	3,330	1,998	1,379	3,377
4	Brown Forman	2085	3,332	44,982	3,132	48,114
4	Cenco Instruments	3811	3,332	58,310	3,315	61,625
5	Crompton & Knowles	3550	3,330	12,654	3,010	15,664
8	Crown Cork & Seal	3221	3,332	41,650	42	41,692
4	Electrolux	3630	3,332	17,493	3,182	20,675
8	Ethyl	2899	3,333	119,988	4,100	124,088
8	Green Giant	2030	3,330	17,982	2,757	20,739

TABLE 28 (Continued)

PORTFOLIO M 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Grumman Aircraft Engineering	3721	3,348	2,418	1,034	3,452
8	Gulf & Western Industries	9998	3,332	44,982	79,968	124,950
6	Hat Corporation of America	2300	3,335	3,335	734	4,069
8	Heller (Walter E.)	6140	3,332	6,664	3,057	9,721
4	Hoover	3630	3,336	12,510	3,678	16,188
4	Host International	5812	3,333	49,995	4,200	54,195
5	Indian Head	2200	3,332	31,654	1,916	33,570
4	International Silver	3999	3,333	2,424	830	3,254
8	Kennametal	3399	3,335	9,338	2,294	11,632
5	Leesona	3550	3,336	12,788	1,012	13,800
8	National Airlines	4511	3,339	9,646	315	9,961
5	Pittsburgh Brewing	2082	3,332	11,662	3,549	15,211
3	Prentice-Hall	2700	3,332	28,322	2,516	30,838
7	Publicker	2085	3,330	1,110	0	1,110
	Total:		100,000	643,240	141,359	784,599

TABLE 29

PORTFOLIO N 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	3,572	8,037	45	8,082
8	Allen Electric Equipment	3714	3,572	12,502	616	13,118
7	American Beverage	2086	3,571	28,568	0	28,568
5	American Motors	3711	3,570	7,140	7,771	14,911
8	Avco	3721	3,570	11,305	3,249	14,554
6	Avis Industrial	3679	3,570	21,420	1,125	22,545
8	Baldwin (D. H.)	3931	3,576	11,175	1,954	13,119
3	British Petroleum	2913	3,570	2,142	1,478	3,620
4	Brown Forman	2085	3,570	48,195	3,356	51,551
4	Cenco Instruments	3811	3,570	62,475	3,552	66,027
5	Crompton & Knowles	3550	3,570	13,566	3,227	16,793
8	Crown Cork & Seal	3211	3,572	44,650	45	44,695
4	Electrolux	3630	3,572	18,753	3,411	22,164
8	Ethyl	2899	3,571	128,556	4,392	132,948
8	Green Giant	2030	3,570	19,278	2,956	22,234
8	Grumman Aircraft Engineering	3721	3,582	2,587	1,106	3,693

TABLE 29 (Continued)

PORTFOLIO N 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Gulf & Western Industries	9998	3,570	48,195	827	49,052
8	Heller (Walter E.)	6140	3,572	7,144	3,277	10,421
4	Hoover	3630	3,568	13,380	3,934	17,314
4	Host International	5812	3,572	53,580	4,501	58,081
5	Indian Head	2200	3,572	33,934	2,054	35,988
4	International Silver	3999	3,575	2,600	891	3,491
8	Kennametal	3399	3,570	9,996	2,456	12,452
5	Leesona	3550	3,570	13,685	1,083	14,768
8	National Airlines	4511	3,573	10,322	337	10,659
5	Pittsburgh Brewing	2082	3,570	12,495	3,802	16,297
3	Prentice-Hall	2700	3,570	30,345	2,695	33,040
7	Publicker	2085	3,570	1,190	0	1,190
	Total:		100,000	677,215	64,160	741,375

TABLE 30

PORTFOLIO O 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	4,000	9,000	50	9,050
8	Allen Electric Equipment	3714	4,000	14,000	690	14,690
7	American Beverage	2086	4,000	32,000	0	32,000
5	American Motors	3711	4,002	8,004	8,711	16,715
6	Avis Industrial	3679	4,000	24,000	1,260	25,260
8	Baldwin (D. H.)	3931	4,000	12,500	2,175	14,675
3	British Petroleum	2913	4,000	2,400	1,656	4,056
4	Brown Forman	2085	4,000	54,000	3,760	57,760
4	Cenco Instruments	3811	4,000	70,000	3,980	73,980
5	Crompton & Knowles	3550	4,000	15,200	3,616	18,816
8	Crown Cork & Seal	3221	4,000	50,000	50	50,050
4	Electrolux	3630	4,000	21,000	3,820	24,820
8	Ethyl	2899	4,000	144,000	4,920	148,920
8	Green Giant	2030	4,000	21,600	3,312	24,912
8	Gulf & Western Industries	9998	4,000	54,000	960	54,960
8	Heller (Walter E.)	6140	4,000	8,000	3,670	11,670

TABLE 30 (Continued)

PORTFOLIO O 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Hoover	3630	4,000	15,000	4,410	19,410
4	Host International	5812	4,000	60,000	5,040	65,040
5	Indian Head	2200	4,000	38,000	2,300	40,300
4	International Silver	3999	4,004	2,912	997	3,909
8	Kennametal	3399	4,000	11,200	2,752	13,952
5	Leesona	3550	4,002	15,341	1,214	16,555
8	National Airlines	4511	3,996	11,544	377	11,921
5	Pittsburgh Brewing	2082	4,000	14,000	4,260	18,260
7	Publicker	2085	3,996	1,332	0	1,332
	Total:		100,000	709,033	63,980	773,013

TABLE 31

PORTFOLIO P 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	5,000	11,250	63	11,313
8	Allen Electric Equipment	3714	5,000	17,500	863	18,363
7	American Beverage	2086	5,000	40,000	0	40,000
5	American Motors	3711	4,998	9,996	10,879	20,875
6	Avis Industrial	3679	5,000	30,000	1,575	31,575
8	Baldwin (D. H.)	3931	5,000	15,625	2,719	18,344
3	British Petroleum	2913	5,000	3,000	2,070	5,070
4	Cenco Instruments	3811	5,000	87,500	4,975	92,475
5	Crompton & Knowles	3550	5,000	19,000	4,520	23,520
8	Crown Cork & Seal	3221	5,000	62,500	63	62,563
8	Ethyl	2899	5,000	180,000	6,150	186,150
8	Green Giant	2030	5,000	27,000	4,140	31,140
8	Gulf & Western Industries	9998	5,000	67,500	1,200	68,700
8	Heller (Walter E.)	6140	5,000	10,000	4,588	14,588
4	Host International	5812	5,000	75,000	6,300	81,300
5	Indian Head	2200	5,002	47,519	2,876	50,395

TABLE 31 (Continued)

PORTFOLIO P 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Leesona	3550	4,998	19,159	1,516	20,675
8	National Airlines	4511	5,004	14,456	473	14,929
5	Pittsburgh Brewing	2082	5,000	17,500	5,325	22,825
7	Publicker	2085	4,998	1,666	0	1,666
	Total:		100,000	756,171	60,295	816,466

TABLE 32

PORTFOLIO Q 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
1	Avon Products	2844	5,000	175,000	10,025	185.025
4	Belden	3400	4,998	0	1,714	1,714
2	Black & Decker	3550	4,995	15,540	2,525	18,065
4	Burlington Industries	2200	5,000	21,875	3,444	25,319
1	Bristol-Myers	2830	5,000	43,000	3,420	46,420
1	Chesebrough Pond's	2844	5,000	21,000	3,560	24,560
3	Coca-Cola Bottling NY	2086	5,005	7,732	4,059	11,794
8	Collins Radio	3670	5,000	4,800	328	5,128
1	Consolidated Cigars	2121	5,000	42,500	7,050	49,550
7	Curtis Publishing	2700	5,005	2,145	1,144	3,289
2	Lane Bryant	5600	4,998	14,280	3,756	18,036
8	GAF	2800	5,000	13,125	188	13,313
8	General Finance	6145	4,995	6,660	3,674	10,334
5	Giant Yellownife	1042	4,998	5,831	4,631	10,462
3	Gimbel Brothers	5311	5,005	5,390	1,913	7,303
5	Parker Hannifin	3560	4,998	58,310	6,781	65,091

TABLE 32 (Continued)

PORTFOLIO Q 1956-1965 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Rohr	3725	5,005	7,735	2,926	10,661
8	Talcott (James)	6140	5,000	6,250	5,044	11,294
8	Thiokol Chemical	3721	4,998	28,322	0	28,322
1	Zenith	3651	5,000	71,250	6,388	77,638
	Total:		100,000	550,748	72,570	623,318

APPENDIX D

Equal Shares Strategy

In the tables which follow, an initial investment of $100,000 is assumed to be made in dollar amounts of each security sufficient to purchase an approximately equal number of shares of each security, subject to the constraint of the available funds, in each of the seventeen portfolios, A through Q, inclusive, on the first business day of 1956 and liquidated on the last business day of 1965.

The tables indicate the risk class of each portfolio security, the name of the issuing company, the COMPUSTAT industry number, the initial investment, the capital gain from that investment, the dividend income received during the holding period from that investment, and the total return from that investment (capital gain plus dividend income).

Portfolio totals indicate the total initial investment, the total capital gain, the total dividend income, and the total (holding period) return.

TABLE 33

PORTFOLIO A 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
1	Avon Products	2844	2,898	101,430	5,810	107,240
4	Brown Forman	2085	2,898	39,123	2,724	41,847
4	Cenco Instruments	3811	2,898	50,715	2,884	53,599
8	Crown Cork & Seal	3221	5,796	72,450	72	72,522
3	Diebold	3570	2,898	40,572	3,028	43,600
4	Emerson Electric	3610	7,245	73,899	8,390	82,289
4	Emery Airfreight	4511	4,347	94,185	5,637	99,822
8	Ethyl	2899	1,449	52,164	1,782	53,946
3	Factor, Max	2844	4,350	46,400	5,336	51,736
4	Fairchild Camera	3670	8,700	136,300	3,393	139,693
8	Gulf & Western Industries	9998	2,898	39,123	174	39,297
3	Hart Schaffner & Marx	2300	4,347	52,164	5,043	57,207
4	Lukens Steel	3310	7,245	69,552	8,288	77,840
1	Magnavox	3651	2,898.	56,511	3,594	60,075
5	Northwest Airlines	4511	7,245	85,491	3,405	88,896
4	Polaroid	3861	4,347	165,186	811	165,997

TABLE 33 (Continued)

PORTFOLIO A 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain($)	Dividend Income ($)	Total Return ($)
2	Tampax	2600	14,500	149,350	15,863	165,213
2	Thrifty Drug Stores	5331	2,898	27,531	5,477	33,008
2	Xerox	3570	4,347	288,351	2,246	209,597
1	Zenith	3651	5,796	82,593	7,404	89,997
	Total:		100,000	1,723,090	91,361	1,814,451

TABLE 34

PORTFOLIO B 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Associated Brewing	2082	2,175	-435	73	-362
4	Bath Industries	3731	7,975	-5,800	1,643	-4,157
3	Borg Warner	3714	6,090	-2,465	1,686	-779
6	Babbit (B. T.)	2899	870	-290	131	-159
7	C F & I Steel	3310	3,888	-1,296	543	-753
8	Colt Industries	3560	6,815	-3,480	131	-3,349
7	Cudahy	2010	1,160	-145	0	-145
6	Elgin National Watch	3871	2,465	-1,015	203	-812
5	Foote Mineral	1000	5,655	-2,320	564	-1,756
8	Hazeltine	3670	3,045	-1,885	948	-937
2	International Salt	2800	14,935	-9,280	3,608	-5,672
6	Neisner Brothers	5331	2,465	-1,160	747	-413
5	Penn-Dixie Cement	3241	4,640	-2,900	1,769	-1,131
4	Potlatch Forests	0800	6,525	-2,465	1,306	-1,159
7	Pittsburgh Steel	3310	3,770	-1,466	276	-1,190
6	Rath Packing	2010	3,312	-1,872	773	-1,199

TABLE 34 (Continued)

PORTFOLIO B 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return($)
2	Skelly Oil	1311	8,120	-2,360	1,215	-1,145
3	Sprague Electric	3679	6,670	-3,045	847	-2,198
6	Steep Rock Iron Mines	1000	2,465	-1,601	128	-1,473
4	Swift	2010	6,960	-3,072	1,565	-1,507
	Total:		100,000	-48,352	18,156	-30,196

TABLE 35

PORTFOLIO C 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	Allied Chemical	2800	5,292	-686	1,572	886
4	American Can	3221	4,606	882	1,960	2,842
5	American Radiator	3430	2,300	-200	900	700
1	American Telephone & Telegraph	4811	2,970	3,069	2,120	5,189
2	American Tobacco	2111	1,980	1,881	1,338	3,269
3	Atchinson Topeka Santa Fe	4011	2,475	297	1,510	1,807
1	Borden	2020	1,485	2,574	803	3,377
3	Columbia Gas System	4924	1,782	792	1,071	1,863
3	Consolidated Edison NY	4911	2,277	891	1,456	2,347
1	DuPont	2800	22,638	784	6,738	7,522
1	Eastman Kodak	2800	1,782	9,801	985	10,786
1	General Electric	3600	5,684	5,880	2,519	8,399
4	International Harvester	3522	1,782	2,772	1,151	3,923
2	Mobil Oil	2913	2,574	2,178	1,182	3,360
1	National Biscuit	2052	1,881	3,465	1,334	4,799
1	Otis Elevator	3550	1,881	3,762	1,413	5,175

TABLE 35 (Continued)

PORTFOLIO C 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Pacific Gas & Electric	4911	1,584	1,980	919	2,899
6	Pennsylvania Railroad	4011	2,058	3,136	764	3,900
1	Proctor & Gamble	2841	2,475	4,356	1,274	5,630
1	Sears, Roebuck	5322	1,782	4,752	766	5,518
1	Standard Oil of California	2913	3,822	3,626	1,684	5,310
1	Standard Oil of New Jersey	2913	5,049	2,871	2,455	5,326
2	Union Carbide	2800	5,445	1,386	1,780	3,166
2	Union Electric	4911	1,386	1,188	809	1,997
2	Union Pacific Railroad	4011	2,772	990	1,634	2,624
4	United States Steel	3310	5,684	-588	2,582	1,994
4	Westinghouse Electric	3600	2,970	3,168	1,119	4,287
3	Woolworth	5331	1,584	1,584	860	2,444
	Total:		100,000	66,591	44,748	111,339

TABLE 36

PORTFOLIO D 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Alcoa	3334	6,600	-825	915	90
3	Allied Chemical	2800	3,996	-518	1,187	669
4	American Can	3221	3,478	666	1,480	2,146
1	American Telephone & Telegraph	4811	2,220	2,294	1,584	3,878
2	American Tobacco	2111	1,500	1,425	1,052	2,477
5	Anaconda	3331	5,325	-2,325	1,295	-1,030
4	Bethlehem Steel	3310	3,034	-74	1,540	1,466
4	Chrysler	3711	1,554	2,368	426	2,794
1	DuPont	2800	17,325	600	5,156	5,756
1	Eastman Kodak	2800	1,332	7,326	736	8,062
1	General Electric	3600	4,350	4,500	1,928	6,428
1	General Foods	2000	1,776	4,366	1,129	5,495
2	General Motors	3711	3,404	4,292	2,161	6,453
2	Goodyear	3000	1,406	2,146	662	2,808
4	International Harvester	3522	1,350	2,100	872	2,972
3	International Nickel	1000	3,034	3,626	1,453	5,079

TABLE 36 (Continued)

PORTFOLIO D 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	International Paper	2600	2,368	-74	731	657
2	Johns Manville	2950	3,256	814	1,502	2,316
2	Owens Illinois Glass	3221	2,516	2,146	932	3,078
1	Proctor & Gamble	2841	1,850	3,256	952	4,208
1	Sears, Roebuck	5322	1,332	3,552	573	4,125
1	Standard Oil of California	2913	2,886	2,738	1,271	4,009
1	Standard Oil of New Jersey	2913	3,774	2,146	1,835	3,981
4	Swift	2010	3,552	-1,554	804	-750
1	Texaco	2913	1,998	3,922	1,153	5,075
2	Union Carbide	2800	4,070	1,036	1,331	2,367
8	United Aircraft	3721	2,960	3,108	1,120	4,228
4	United States Steel	3310	4,350	-450	1,976	1,526
4	Westinghouse Electric	3600	2,220	2,368	836	3,204
3	Woolworth	5331	1,184	1,184	643	1,827
	Total:		100,000	56,159	39,235	95,394

TABLE 37

PORTFOLIO E 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	Air Reduction	2800	3,440	-258	1,126	868
4	Alcoa	3334	7,568	-946	1,049	103
3	Allied Chemical	2800	4,590	-595	1,363	768
1	American Telephone & Telegraph	4811	2,580	2,666	1,841	4,507
2	American Tobacco	2111	1,720	1,634	1,206	2,840
4	Bethlehem Steel	3310	3,526	-86	1,790	1,704
2	Caterpillar Tractor	3531	860	3,440	465	3,905
4	Chrysler	3711	1,806	2,752	495	3,247
1	DuPont	2800	19,635	680	5,844	6,524
1	Eastman Kodak	2800	1,548	8,514	856	9,370
1	General Electric	3600	4,930	5,100	2,185	7,285
2	General Motors	3711	3,956	4,988	2,511	7,499
3	Goodrich	3000	7,395	-2,550	1,870	-680
3	Ingersoll Rand	3560	3,010	1,720	1,699	3,419
4	International Harvester	3522	1,530	2,380	989	3,369
3	International Nickel	1000	3,526	4,214	1,689	5,903

TABLE 37 (Continued)

PORTFOLIO E 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Johns Manville	2950	3,784	946	1,746	2,692
4	Kennecott Copper	3331	3,354	172	1,548	1,720
8	McDonnell Douglas	3721	172	1,720	130	1,850
2	Penney	5311	2,838	2,752	1,276	4,028
1	Sears, Roebuck	5322	1,548	4,128	666	4,794
1	Standard Oil of New Jersey	2913	4,386	2,494	2,133	2,627
2	Union Carbide	2800	4,730	1,204	1,548	2,750
4	United States Steel	3310	4,988	-516	2,266	1,750
4	Westinghouse Electric	3600	2,580	2,752	972	3,724
	Total:		100,000	49,305	39,261	88,566

TABLE 38

PORTFOLIO F 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	Air Reduction	2800	2,480	-186	812	626
4	Alcoa	3334	5,368	-671	744	73
4	American Smelting & Refining	1000	1,550	2,914	854	3,768
1	American Telephone & Telegraph	4811	1,860	1,922	1,327	3,249
2	Caterpillar Tractor	3531	620	2,480	335	2,815
4	Chrysler	3711	1,302	1,984	357	2,341
4	Continental Can	3221	1,798	806	775	1,581
2	Continental Oil	2912	3,100	1,302	1,115	2,417
1	Corn Products	2046	930	1,798	755	2,553
2	Dow Chemical	2800	3,410	1,364	864	2,228
1	DuPont	2800	14,322	496	4,263	4,759
1	Eastman Kodak	2800	1,116	6,138	617	6,755
1	General Electric	3600	3,596	3,720	1,593	5,313
2	General Motors	3711	2,852	3,596	1,810	5,406
3	Ingersoll Rand	3560	2,170	1,240	1,225	2,465
2	Inland Steel	3310	1,708	1,037	991	2,028

TABLE 38 (Continued)

PORTFOLIO F 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Insurance Company of No. America	6333	2,914	2,294	889	3,183
1	International Business Machines	3570	2,170	17,980	944	18,924
4	International Harvester	3522	1,116	1,736	721	2,457
3	International Nickel	1000	2,542	3,038	1,218	4,256
4	Kennecott Copper	3331	2,418	124	1,116	1,240
4	Liggett & Myers	2111	4,278	124	3,147	3,271
2	Monsanto Chemical	2800	2,418	2,666	682	3,348
2	Owens Illinois Glass	3221	2,108	1,798	781	2,579
2	Parke Davis	2830	854	1,220	649	1,869
1	Procter & Gamble	2841	1,550	2,728	798	3,526
4	Pullman	3740	2,294	1,240	1,190	2,430
3	Radio Corporation of America	3600	806	2,046	255	2,301
1	Reynolds (R. J.)	2111	806	1,922	812	2,734
1	Sears, Roebuck	5322	1,116	2,976	480	3,456
1	Standard Oil of New Jersey	2913	3,162	1,798	1,538	3,336
1	Texaco	2913	1,674	3,286	966	4,252

TABLE 38 (Continued)

PORTFOLIO F 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Union Carbide	2800	3,410	868	1,115	1,983
2	Union Pacific Railroad	4011	1,736	620	1,023	1,643
8	United Aircraft	3721	2,480	2,604	939	3,543
3	United States Gypsum	2950	3,968	186	1,835	2,021
3	United States Rubber	3000	1,550	806	655	1,461
4	United States Steel	3310	3,596	-372	1,634	1,262
4	Westinghouse Electric	3600	1,860	1,984	701	2,685
3	Woolworth	5331	992	992	539	1,531
	Total:		100,000	84,604	43,064	127,668

TABLE 39

PORTFOLIO G 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Admiral	3651	2,574	5,148	117	5,265
5	Allis Chalmers	3522	7,956	0	2,705	2,705
4	American Airlines	4511	5,640	1,645	1,340	2,985
6	Callahan Mining	9998	1,170	936	0	936
5	Fedders	3430	2,340	1,872	2,183	4,055
5	Franklin Stores	5311	2,574	-468	962	494
8	General Acceptance	6140	3,276	1,638	2,300	3,938
5	Giant Yellowmife Mines	1042	1,404	1,638	1,301	2,939
2	Grinnell	3430	9,126	21,528	3,770	25,298
2	H. J. Heinz	2030	4,446	5,850	2,090	7,940
8	Industrial Acceptance	6140	3,042	1,872	2,048	3,920
2	International Salt	2800	24,102	-14,976	5,822	-9,154
6	I T E Circuit Breaker	3610	3,042	6,318	1,310	7,628
2	Lane Bryant	5600	1,638	4,680	1,231	5,911
2	Monsanto	2800	9,126	10,062	2,574	12,636
8	National Airlines	4511	2,106	6,084	246	6,330

TABLE 39 (Continued)

PORTFOLIO G 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Pabst Brewing	2082	2,340	7,020	629	7,649
3	Prentice-Hall	2700	468	3,978	353	4,331
2	Quaker Oats	2000	7,050	1,880	2,451	4,331
4	Waukesha Motor	3560	6,580	3,525	4,724	8,249
	Total:		100,000	70,230	38,156	108,386

TABLE 40

PORTFOLIO H 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Abbott Laboratories	2830	3,962	9,622	1,933	11,555
2	Addressograph Mimeograph	3570	5,094	11,603	2,372	13,975
3	Air Products & Chemicals	2800	1,415	9,339	258	9,597
5	Allied Products	3449	4,811	5,094	1,191	6,285
1	Avon Products	2844	566	19,810	1,135	20,945
3	British Petroleum	2913	1,415	849	586	1,435
4	Burroughs	3570	8,773	5,377	2,830	8,207
4	Cenco Instruments	3811	566	9,905	563	10,468
6	Cherry Burrell	3449	4,245	1,132	1,033	2,165
3	Colgate-Palmolive	2841	3,113	4,811	2,015	6,826
4	Evans Products	0800	3,692	7,952	897	8,849
3	Hall (W. F.) Printing	2731	6,226	3,113	4,089	7,202
5	Jaeger Machine	3531	4,528	-849	2,456	1,607
4	Kelsey Hayes	3714	4,811	1,981	3,000	4,981
5	Mansfield Tire & Rubber	3000	2,264	566	1,160	1,726
4	Murphy (G. W.) Industries	3533	5,377	3,113	1,152	4,265

TABLE 40 (Continued)

PORTFOLIO H 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Potlatch Forests	0800	12,735	-4,811	2,567	-2,244
2	Simplicity Pattern	2700	1,415	3,679	795	4,474
4	United Shoe Machinery	3550	16,472	2,556	8,165	10,721
4	Westinghouse Air Brake	3740	8,520	3,124	3,735	6,859
	Total:		100,000	97,966	41,932	139,898

TABLE 41

PORTFOLIO I 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Abbott Laboratories	2830	3,934	9,554	1,919	11,473
2	Armstrong Cork	2510	4,230	12,972	2,589	15,561
4	Diamond International	2650	5,058	5,940	2,558	8,498
3	Fafnir Bearing	3569	5,922	8,179	4,839	13,017
3	Hammond	3999	3,372	3,934	3,695	7,629
4	Hoover	3630	1,124	4,234	1,244	5,478
5	Island Creek Coal	1211	10,116	562	4,763	5,325
2	Johns Manville	2950	12,364	3,091	5,704	8,795
4	Massey Fergusson	3522	2,820	6,486	1,337	7,823
3	Moore	2761	3,934	1,424	728	2,152
8	National Airlines	4511	2,529	7,341	296	7,637
3	National Steel	3310	10,152	7,332	4,887	12,219
4	Purolator Products	3714	3,372	6,780	1,943	8,723
4	Republic Steel	3310	13,818	-1,692	7,264	5,572
2	Simplicity Pattern	2700	1,450	3,626	792	4,418
3	Square D Company	3622	1,124	6,490	1,196	7,686

TABLE 41 (Continued)

PORTFOLIO I 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Stone Container	2650	1,686	5,339	1,085	6,424
2	Sunbeam	3630	4,777	10,733	2,394	13,127
5	United States Pipe & Foundry	3312	6,768	-846	3,384	2,538
3	Wickes	3522	1,450	5,600	1,065	6,665
	Total:		100,000	107,078	53,682	160,760

TABLE 42

PORTFOLIO J 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Amerada Petroleum	1311	9,936	5,832	3,106	8,938
4	American Airlines	4511	5,184	1,512	1,231	2,743
4	American Distilling	2085	2,375	4,536	1,868	6,404
5	Campbell Red Lake Mines	1042	1,512	2,808	866	3,674
4	Chrysler	3711	4,536	6,912	1,242	8,154
3	Container Corporation of America	2650	4,104	3,240	2,078	5,318
4	Continental Baking	2151	7,776	-2,592	2,538	-54
6	Duquesne Brewing	2082	1,080	864	994	1,858
4	Duval	1477	7,560	11,232	2,830	14,062
3	Heller (Walter E.)	6140	860	1,720	811	2,531
4	Kaiser Aluminum & Chemical	3334	8,856	-864	1,935	1,071
5	Keebler	2052	6,480	0	2,711	2,711
1	Kellogg	2000	2,160	6,696	1,486	8,182
4	Koppers	2800	6,480	216	2,350	2,566
5	Montgomery Ward	5322	10,152	-2,808	3,240	432
5	Penn-Dixie Cement	3241	6,912	-4,320	2,635	-1,685

TABLE 42 (Continued)

PORTFOLIO J 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
1	Plough	2830	1,512	8,424	1,028	9,452
3	Rayonier	0800	7,560	216	1,801	2,017
3	Rexall	2800	860	9,030	462	9,492
2	Rex Chainbelt	3531	4,104	3,240	2,130	5,370
	Total:		100,000	55,894	37,342	93,236

TABLE 43

PORTFOLIO K 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	American Crystal Sugar	2063	2,574	2,106	1,594	3,700
5	American Motors	3711	702	1,404	1,528	2,932
4	Amsted Industries	3740	4,914	6,318	3,487	9,805
1	Anchor Hocking Glass	3221	4,446	5,148	2,972	8,120
1	Avon Products	2844	470	16,450	942	17,392
4	Clevite	3714	5,382	6,786	2,939	9,725
4	De Vilbiss	3550	1,645	4,465	1,720	6,185
6	Duquesne Brewing	2082	1,170	936	1,076	2,012
4	Flintkote	2950	5,382	-468	2,881	2,413
3	Goodrich	3000	20,358	-7,020	5,148	-1,872
2	Grinnell	3430	9,165	21,620	3,786	25,406
4	Interstate Department Stores	5311	1,170	6,786	555	7,341
1	Kellogg	2000	2,340	7,254	1,610	8,864
4	Lone Star Brewing	2082	2,340	1,872	1,711	3,583
3	Medusa Portland Cement	3241	6,084	-234	2,352	2,118
5	National Sugar Refining	2062	8,658	-3,978	2,504	-1,474

TABLE 43 (Continued)

PORTFOLIO K 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Newberry	5331	7,990	-3,290	3,248	-42
4	Purex	2899	702	5,148	686	5,834
5	St. Joseph Lead	1031	7,020	4,446	2,546	6,992
3	Tecumseh Products	3430	7,488	9,828	5,370	15,198
	Total:		100,000	85,577	48,655	134,232

TABLE 44

PORTFOLIO L 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Admiral	3651	5,555	11,110	253	11,363
7	Alleghany Airlines	4511	2,020	4,545	25	4,570
8	Allen Electric Equipment	3714	2,020	7,070	348	7,418
7	American Beverage	2086	505	4,040	0	4,040
4	American Enka	2823	5,555	13,130	2,611	15,741
5	American Motors	3711	1,515	3,030	3,298	6,328
8	Avco	3721	3,030	9,595	2,757	12,352
6	Avis Industrial	3679	1,010	6,060	318	6,378
8	Baldwin (D. H.)	3931	4,040	12,625	2,197	14,822
5	Braniff Airways	4511	3,535	14,645	879	15,524
3	British Petroleum	2913	2,525	1,515	1,045	2,560
4	Brown Forman	2085	1,010	13,635	949	14,584
6	Callahan Manufacturing	9998	2,530	2,024	0	2,024
4	Cenco Instruments	3811	1,010	17,675	1,005	18,680
5	Cooper Tire & Rubber	3000	1,515	6,565	1,646	8,211
5	Crompton & Knowles	3550	2,530	9,614	2,287	11,901

TABLE 44 (Continued)

PORTFOLIO L 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Crown Cork & Seal	3221	2,020	25,250	25	25,275
4	Electrolux	3630	2,020	10,605	1,929	12,534
8	Ethyl	2899	505	18,180	621	18,801
8	Green Giant	2030	2,525	13,635	2,091	15,726
8	Grumman Aircraft Engineering	3721	9,090	6,565	2,808	9,373
8	Gulf & Western Industries	9998	1,010	13,635	242	13,877
5	Hamilton Watch	3871	2,525	2,525	1,242	3,767
6	Hat Corporation of America	2300	2,525	2,525	556	3,081
8	Heller (Walter E.)	6140	2,020	4,040	1,853	5,893
4	Hoover	3630	2,020	7,575	2,227	9,802
4	Host International	5812	505	7,575	636	8,211
5	Indian Head	2200	1,010	9,595	581	10,176
4	International Silver	3999	5,555	4,040	1,384	5,424
8	Kennametal	3399	2,525	7,070	1,737	8,807
5	Leesona	3550	3,030	11,615	919	12,534
8	McGraw-Hill	2731	4,040	11,110	1,773	12,883

TABLE 44 (Continued)

PORTFOLIO L 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
1	Magnavox	3651	1,010	19,695	1,252	20,947
8	National Airlines	4511	4,545	13,130	429	13,559
5	Northwest Airlines	4511	2,525	29,795	1,187	30,982
5	Pittsburgh Brewing	2082	1,010	3,535	1,076	4,611
7	Publicker	2085	3,030	1,010	0	1,010
3	Prentice-Hall	2700	1,010	8,585	763	9,348
2	Simplicity Pattern	2700	2,525	6,565	1,419	7,984
2	Xerox	3570	1,515	100,495	783	101,278
	Total:		100,000	475,228	47,151	522,379

TABLE 45

PORTFOLIO M 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	2,776	6,246	35	6,241
8	Allen Electric Equipment	3714	2,776	9,716	479	10,195
7	American Beverage	2086	694	5,552	0	5,552
4	American Enka	2823	7,645	18,070	3,593	21,663
5	American Motors	3711	2,085	4,170	4,538	8,708
8	Avco	3721	4,164	13,186	3,789	16,975
6	Avis Industrial	3679	1,388	8,328	437	8,765
8	Baldwin (D. H.)	3931	5,552	17,350	3,019	20,369
3	British Petroleum	2913	3,470	2,082	1,437	3,519
4	Brown Forman	2085	1,388	18,738	1,305	20,043
4	Cenco Instruments	3811	1,388	24,290	1,381	25,671
5	Crompton & Knowles	3550	3,470	13,186	3,137	16,323
8	Crown Cork & Seal	3221	2,776	34,700	35	34,735
4	Electrolux	3630	2,776	14,574	2,651	17,225
8	Ethyl	2899	694	24,984	854	25,838
8	Green Giant	2030	3,470	18,738	2,873	21,611

TABLE 45 (Continued)

PORTFOLIO M 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Grumman Aircraft Engineering	3721	12,510	9,035	3,864	12,899
8	Gulf & Western Industries	9998	1,388	18,738	333	19,071
6	Hat Corporation of America	2300	3,470	3,470	763	4,233
8	Heller (Walter E.)	6140	2,776	5,552	2,547	8,099
4	Hoover	3630	2,776	10,410	3,061	13,471
4	Host International	5812	694	10,410	874	11,284
5	Indian Head	2200	1,388	13,186	798	13,984
4	International Silver	3999	7,645	5,560	1,904	7,464
8	Kennametal	3399	3,470	9,716	2,387	12,103
5	Leesona	3550	4,170	15,985	1,265	17,250
8	National Airlines	4511	6,255	18,070	591	18,661
5	Pittsburgh Brewing	2082	1,388	4,858	1,478	6,336
3	Prentice Hall	2700	1,388	11,798	1,048	12,846
7	Publicker	2085	4,170	1,390	0	1,390
	Total:		100,000	372,088	50,476	422,564

TABLE 46

PORTFOLIO N 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	3,124	7,029	39	7,068
8	Allen Electric Equipment	3714	3,124	10,934	539	11,473
7	American Beverage	2086	781	6,248	0	6,248
5	American Motors	3711	2,343	4,686	5,100	9,786
8	Avco	3721	4,686	14,839	4,264	19,103
6	Avis Industrial	3679	1,562	9,372	492	9,864
8	Baldwin (D. H.)	3931	6,248	19,525	3,397	22,922
3	British Petroleum	2913	3,905	2,343	1,617	3,960
4	Brown Forman	2085	1,562	21,087	1,468	22,555
4	Cenco Instruments	3811	1,562	27,335	1,554	28,889
5	Crompton & Knowles	3550	3,910	14,858	3,535	18,393
8	Crown Cork & Seal	3221	3,124	39,050	39	39,089
4	Electrolux	3630	3,124	16,401	2,983	19,384
8	Ethyl	2899	781	28,116	961	29,077
8	Green Giant	2030	3,905	21,087	3,233	24,320
8	Grumman Aircraft Engineering	3721	14,076	10,166	4,348	14,514

TABLE 46 (Continued)

PORTFOLIO N 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Gulf & Western Industries	9998	1,562	21,087	375	21,462
8	Heller (Walter E.)	6140	3,124	6,248	2,866	9,114
4	Hoover	3630	3,124	11,715	3,444	15,159
4	Host International	5812	781	11,715	984	12,699
5	Indian Head	2200	1,562	14,839	898	15,737
4	International Silver	3999	8,591	6,248	2,140	8,388
8	Kennametal	3399	3,905	10,934	2,687	13,621
5	Leesona	3550	4,686	17,963	1,421	19,384
8	National Airlines	4511	7,038	20,332	665	20,997
5	Pittsburgh Brewing	2082	1,562	5,467	1,664	7,131
3	Prentice-Hall	2700	1,562	13,277	1,179	14,456
7	Publicker	2085	4,686	1,562	0	1,562
	Total:		100,000	394,463	51,892	446,355

TABLE 47

PORTFOLIO O 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	3,920	8,830	49	8,869
8	Allen Electric Equipment	3714	3,920	13,720	676	14,396
7	American Beverage	2086	980	7,840	0	7,840
5	American Motors	3711	2,940	5,880	6,399	12,279
6	Avis Industrial	3679	1,960	11,760	617	12,377
8	Baldwin (D. H.)	3931	7,840	24,500	4,263	28,763
3	British Petroleum	2913	4,900	2,940	2,029	4,969
4	Brown Forman	2085	1,960	26,460	1,842	28,302
4	Cenco Instruments	3811	1,960	34,300	1,950	36,250
5	Crompton & Knowles	3550	4,900	18,620	4,430	23,050
8	Crown Cork & Seal	3221	3,920	49,000	49	49,049
4	Electrolux	3630	3,920	20,580	3,744	24,324
8	Ethyl	2899	980	35,280	1,205	36,485
8	Green Giant	2030	4,900	26,460	4,057	30,517
8	Gulf & Western Industries	9998	1,960	26,460	470	26,930
8	Heller (Walter E.)	6140	3,920	7,840	3,597	11,437

TABLE 47 (Continued)

PORTFOLIO O 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Hoover	3630	3,920	14,700	4,322	19,022
4	Host International	5812	981	14,715	1,236	15,951
5	Indian Head	2200	1,960	18,620	1,127	19,747
4	International Silver	3999	10,791	7,848	2,688	10,536
8	Kennametal	3399	4,905	13,734	3,375	17,109
5	Leesona	3550	5,886	22,563	1,785	24,348
8	National Airlines	4511	8,829	25,506	834	26,340
5	Pittsburgh Brewing	2082	1,962	6,867	2,090	8,957
7	Publicker	2085	5,886	1,962	0	1,962
	Total:		100,000	446,975	52,834	499,809

TABLE 48

PORTFOLIO P 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	5,264	11,844	66	11,910
8	Allen Electric Equipment	3714	5,264	18,424	908	19,332
7	American Beverage	2086	1,316	10,528	0	10,528
5	American Motors	3711	3,948	7,896	8,593	16,489
6	Avis Industrial	3679	2,632	15,792	829	16,621
8	Baldwin (D. H.)	3931	10,520	32,875	5,720	38,595
3	British Petroleum	2913	6,580	3,948	2,724	6,672
4	Cenco Instruments	3811	2,632	46,060	2,619	48,679
5	Crompton & Knowles	3550	6,580	25,004	5,948	30,952
8	Crown Cork & Seal	3221	5,264	65,800	66	65,866
8	Ethyl	2899	1,316	47,376	1,619	48,995
8	Green Giant	2030	6,580	35,532	5,448	40,930
8	Gulf & Western Industries	9998	2,632	35,532	632	36,164
8	Heller (Walter E.)	6140	5,264	10,528	4,830	15,358
4	Host International	5812	1,316	19,740	1,658	21,398
5	Indian Head	2200	2,632	25,004	1,513	26,517

TABLE 48 (Continued)

PORTFOLIO P 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Leesona	3550	7,896	30,268	2,395	32,663
8	National Airlines	4511	11,844	34,216	1,119	35,335
5	Pittsburgh Brewing	2082	2,630	9,205	2,801	2,006
7	Publicker	2085	7,890	2,630	0	2,630
	Total:		100,000	488,202	49,488	537,690

TABLE 49

PORTFOLIO Q 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
1	Avon Products	2844	1,212	42,420	2,430	44,850
4	Belden	3400	10,302	0	3,533	3,533
2	Black & Decker	3550	5,454	16,968	2,757	19,725
4	Burlington Industries	2200	4,848	21,210	3,339	24,549
1	Bristol-Myers	2830	3,035	26,101	2,076	28,177
1	Chesebrough Pond's	2844	3,035	12,747	2,161	14,908
3	Coca-Cola Bottling NY	2086	6,666	10,302	5,406	15,708
8	Collins Radio	3670	15,150	14,544	994	15,538
1	Consolidated Cigars	2121	2,424	20,604	3,418	24,022
7	Curtis Publishing	2700	4,242	1,818	970	2,788
2	Lane Bryant	5600	4,242	12,120	3,188	15,308
8	GAF	2800	4,848	12,726	182	12,908
8	General Finance	6145	5,454	7,272	4,012	11,284
5	Giant Yellownife Mines	1042	3,636	4,242	3,369	7,611
3	Gimbel Brothers	5311	7,878	8,484	3,012	11,496
5	Parker Hannifin	3560	1,818	21,210	2,466	23,676

TABLE 49 (Continued)

PORTFOLIO Q 1956-1965 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Rohr	3725	6,666	10,302	3,897	14,199
8	Talcott (James)	6140	4,848	6,060	4,890	10,950
8	Thiokol Chemical	3721	1,818	10,302	0	10,302
1	Zenith	3651	2,424	34,542	3,097	37,639
	Total:		100,000	293,974	55,197	349,171

APPENDIX E

Equal Dollar Strategy

In the tables which follow, an initial investment of $100,000 is assumed to be made in equal dollar amounts in each security of each of the seventeen portfolios, A through Q, inclusive, on the first business day of 1957 and liquidated on the last business day of 1966.

The tables indicate the risk class of each portfolio security, the name of the issuing company, the COMPUSTAT industry number, the initial investment, the capital gain from that investment, the dividend income received during the holding period from that investment, and the total return from that investment (capital gain plus dividend income).

Portfolio totals indicate the total initial investment, the total capital gain, the total dividend income, and the total (holding period) return.

TABLE 50

PORTFOLIO A 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Anheuser Busch	2082	5,004	27,800	4,464	32,264
1	Avon Products	2844	5,000	96,250	6,350	102,600
4	Bausch & Lomb	3831	5,000	33,125	3,631	36,756
5	Braniff Airways	4511	5,004	53,376	1,410	54,786
1	Bristol-Myers	2830	4,998	34,272	2,770	37,042
1	Eastman Kodak	2800	4,998	25,466	2,677	28,143
4	Emerson Electric	3610	5,005	37,895	4,855	42,750
4	Emery Airfreight	4511	5,000	86,000	4,910	90,910
4	Fairchild Camera	3670	5,000	73,000	2,650	76,650
3	General Tire	3721	5,004	22,518	24,269	47,787
3	Lorillard	2111	5,000	20,625	13,725	34,350
2	Motorola	3651	4,992	30,720	2,599	33,319
1	Merck	2830	5,000	33,500	3,335	37,135
5	Northwest Airlines	4511	5,000	143,750	3,438	147,188
1	Plough	2830	5,000	33,750	3,350	37,100
4	Polaroid	3861	5,004	127,602	651	128,253

TABLE 50 (Continued)

PORTFOLIO A 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Richardson Merrell	2830	4,992	24,960	3,245	28,205
2	Tampax	2600	5,000	56,000	6,435	62,435
2	Xerox	3570	5,001	325,065	3,934	328,999
1	Zenith	3651	4,998	74,970	10,529	84,499
	Total:		100,000	1,360,644	109,257	1,470,171

TABLE 51

PORTFOLIO B 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Alpha Portland Cement	3241	4,995	-3,915	1,500	-2,415
4	Bath Industries	3731	5,005	-3,913	844	-3,069
3	Borg Warner	3714	4,995	-2,886	1,158	-1,728
5	Bullard	3540	5,018	-1,930	521	-1,409
8	Colt Industries	3560	5,040	-2,016	0	-2,016
7	C F & I Steel	3310	5,017	-2,953	468	-2,485
7	Cudahy	2010	5,005	-1,820	0	-1,820
[illegible]	Curtis-Wright	3721	4,968	-3,132	1,593	-1,539
4	Foote Mineral	1000	5,031	-1,935	473	-1,462
4	General Portland Cement	3241	4,993	-3,675	1,871	-1,804
2	International Salt	2300	4,995	-3,780	945	-2,835
5	Lehigh Portland Cement	3241	4,995	-3,996	1,132	-2,864
4	Lone Star Cement	3241	5,004	-2,919	1,494	-1,425
[illegible]	New York Shipbuilding	3721	4,982	-3,392	742	-2,650
7	Pittsburgh Steel	3310	5,004	-3,753	136	-3,617
4	Potlatch Forest	0300	4,992	-2,392	946	-1,446

TABLE 51 (Continued)

PORTFOLIO B 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
6	Rath Packing	2010	4,992	-3,840	787	-3,053
6	Steep Rock Iron Mines	1000	4,998	-3,808	278	-3,530
7	Walworth	3430	4,998	-2,646	594	-2,052
5	Wheeling Steel	3310	4,968	-3,816	1,278	-2,538
	Total:		100,000	-62,517	16,760	-45,757

TABLE 52

PORTFOLIO C 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	Allied Chemical	2800	3,572	-1,140	1,254	114
4	American Can	3221	3,667	522	1,757	2,279
5	American Radiator	3430	3,553	418	1,797	2,215
1	American Telephone & Telegraph	4811	3,567	820	2,178	2,998
2	American Tobacco	2111	3,546	2,561	2,870	5,431
3	Atchinson Topeka Santa Fe	4011	3,575	429	2,181	2,610
1	Borden	2020	3,570	4,335	2,203	6,538
3	Columbia Gas System	4924	3,564	1,584	2,228	3,812
3	Consolidated Edison NY	4911	3,565	1,395	2,373	3,768
1	DuPont	2800	3,667	-931	1,292	361
1	Eastman Kodak	2800	3,570	18,190	1,913	20,103
1	General Electric	3600	3,540	1,711	1,245	2,956
4	International Harvester	3522	3,572	3,008	2,324	5,332
2	Mobil Oil	2913	3,584	2,432	1,592	4,024
1	National Biscuit	2052	3,564	5,940	2,846	8,786
1	Otis Elevator	3550	3,564	2,592	2,477	5,069

TABLE 52 (Continued)

PORTFOLIO C 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Pacific Gas & Electric	4911	3,552	4,440	2,171	6,611
6	Pennsylvania Railroad	4011	3,570	5,440	1,454	6,884
1	Procter & Gamble	2841	3,575	6,864	1,991	8,855
1	Sears, Roebuck	5322	3,556	7,874	2,144	10,018
1	Standard Oil of California	2913	3,569	1,411	1,505	2,916
1	Standard Oil of New Jersey	2913	3,599	244	1,586	1,830
2	Union Carbide	2800	3,596	-682	1,141	459
2	Union Electric	4911	3,570	3,060	2,369	5,429
2	Union Pacific Railroad	4011	3,584	1,280	2,163	3,443
4	United States Steel	3310	3,552	-1,776	1,241	-535
4	Westinghouse Electric	3600	3,567	2,337	1,439	3,776
3	Woolworth	5331	3,570	1,190	2,109	3,299
	Total:		100,000	75,548	53,843	129,391

TABLE 53

PORTFOLIO D 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Alcoa	3334	3,312	-504	452	-52
3	Allied Chemical	2800	3,337	-1,065	1,172	107
4	American Can	3221	3,321	486	1,636	2,122
1	American Telephone & Telegraph	4811	3,335	2,990	2,037	5,027
2	American Tobacco	2111	3,348	2,418	2,710	5,128
5	Anaconda	3331	3,312	-1,472	679	-793
4	Bethlehem Steel	3310	3,300	-1,386	1,352	-34
4	Chrysler	3711	3,332	2,744	1,378	4,122
1	DuPont	2800	3,474	-882	1,224	342
1	Eastman Kodak	2810	3,339	17,013	1,789	18,802
1	General Electric	3600	3,360	1,624	1,182	2,806
1	General Foods	2000	3,322	7,550	2,499	10,049
2	General Motors	3711	3,344	1,672	2,413	4,085
2	Goodyear	3000	3,325	2,261	1,269	3,530
4	International Harvester	3522	3,363	2,832	2,188	5,020
3	International Nickel	1000	3,339	2,205	1,295	3,500

TABLE 53 (Continued)

PORTFOLIO D 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	International Paper	2600	3,330	-555	1,141	586
2	Johns Manville	2950	3,332	-68	1,377	1,309
2	Owens Illinois Glass	3221	3,317	2,461	1,359	3,820
1	Proctor & Gamble	2841	3,325	6,384	1,851	8,235
1	Sears, Roebuck	5322	3,332	7,378	2,009	9,387
1	Standard Oil of California	2913	3,311	1,309	1,396	2,705
1	Standard Oil of New Jersey	2913	3,304	224	1,456	1,680
4	Swift	2010	3,344	-1,408	816	-592
1	Texaco	2913	3,321	5,335	2,095	7,630
2	Union Carbide	2800	3,306	-627	1,049	422
8	United Aircraft	3721	3,350	2,144	1,010	3,154
4	United States Steel	3310	3,330	-1,665	1,163	-502
4	Westinghouse Electric	3600	3,335	2,185	1,346	3,501
3	Woolworth	5331	3,300	1,100	1,949	3,049
	Total:		100,000	62,883	45,292	108,175

TABLE 54

PORTFOLIO E 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	Air Reduction	2800	4,029	-1,422	1,983	-439
4	Alcoa	3334	4,048	-616	552	-64
3	Allied Chemical	2800	3,995	-1,275	1,403	128
1	American Telephone & Telegraph	4811	3,973	3,562	2,426	5,988
2	American Tobacco	2111	3,996	2,886	3,235	6,121
4	Bethlehem Steel	3310	4,000	-1,680	1,638	-42
2	Caterpillar Tractor	3531	3,990	5,320	1,670	6,990
4	Chrysler	3711	3,995	3,290	1,652	4,942
1	DuPont	2800	4,053	-1,029	1,428	399
1	Eastman Kodak	2800	3,990	20,330	2,138	22,468
1	General Electric	3600	4,020	1,943	1,414	3,357
2	General Motors	3711	4,004	2,002	2,889	4,891
3	Goodrich	3000	3,996	-702	1,193	491
3	Ingersoll Rand	3560	3,999	-372	1,860	1,488
4	International Harvester	3522	4,009	3,376	2,608	5,984
3	International Nickel	1000	3,975	2,625	1,542	4,167

TABLE 54 (Continued)

PORTFOLIO E 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Johns Manville	2950	4,018	-82	1,661	1,579
4	Kennecott Copper	3331	3,999	-465	1,574	1,109
8	McDonnell Douglas	3721	4,000	44,000	3,540	47,540
2	Penney	5311	3,996	3,996	2,242	6,238
1	Sears, Roebuck	5322	3,990	8,835	2,405	11,240
1	Standard Oil of New Jersey	2313	4,012	272	1,768	2,040
2	Union Carbide	2800	3,944	-748	1,521	773
4	United States Steel	3310	3,996	1,998	1,396	-602
4	Westinghouse Electric	3600	3,973	2,603	1,603	4,206
	Total:		100,000	94,651	46,341	140,992

TABLE 55

PORTFOLIO F 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	Air Reduction	2800	2,550	-900	622	-278
4	Alcoa	3334	2,576	-392	351	-41
4	American Smelting & Refining	1000	2,494	2,580	1,318	3,898
1	American Telephone & Telegraph	4811	2,494	2,236	1,523	3,759
2	Caterpillar	3531	2,490	5,810	1,042	4,362
4	Chrysler	3711	2,492	2,065	1,033	3,098
4	Continental Can	3221	2,496	780	1,018	1,798
2	Continental Oil	2912	2,457	312	738	1,050
1	Corn Products	2046	2,490	4,814	2,022	6,836
2	Dow Chemical	2800	2,501	41	607	648
1	DuPont	2800	2,509	-637	884	247
1	Eastman Kodak	2800	2,499	12,733	1,339	14,072
1	General Electric	3600	2,520	1,218	886	2,104
2	General Motors	3711	2,464	1,232	1,778	3,010
3	Ingersoll Rand	3560	2,494	-232	1,160	928
2	Inland Steel	3310	2,475	-150	1,262	1,112

TABLE 55 (Continued)

PORTFOLIO F 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Insurance Company of No. America	6333	2,491	1,696	869	2,565
1	International Business Machines	3570	2,440	12,040	760	12,800
4	International Harvester	3522	2,489	2,096	1,619	3,715
3	International Nickel	1000	2,544	1,680	987	2,667
4	Kennecott Copper	3331	2,494	-290	981	691
4	Liggett & Myers	2111	2,535	0	1,979	1,979
2	Monsanto	2800	2,480	720	825	1,545
2	Owens Illinois Glass	3221	2,480	1,840	1,016	2,856
2	Parke-Davis	2830	2,512	1,727	1,809	3,536
1	Procter & Gamble	2841	2,500	4,800	1,392	6,192
4	Pullman	3740	2,480	960	1,592	2,552
3	Radio Corporation of America	3600	2,510	8,283	1,122	9,405
1	Reynolds (R. J.)	2111	2,492	3,560	2,547	6,107
1	Sears, Roebuck	5322	2,492	5,518	1,502	7,020
1	Standard Oil of New Jersey	2913	2,478	168	1,092	1,260
1	Texaco	2913	2,484	4,140	1,567	5,707

TABLE 55 (Continued)

PORTFOLIO F 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Union Carbide	2800	2,552	-484	810	326
2	Union Pacific Railroad	4011	2,492	890	1,504	2,394
8	United Aircraft	3721	2,550	1,632	769	2,401
3	United States Gypsum	2950	2,508	-44	1,333	1,289
3	United States Rubber	3000	2,496	1,560	1,124	2,684
4	United States Steel	3310	2,516	-1,258	879	-379
4	Westinghouse Electric	3600	2,494	1,634	1,006	2,540
3	Woolworth	5331	2,490	830	1,471	2,301
	Total:		100,000	82,718	48,138	130,856

TABLE 56

PORTFOLIO G 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Admiral	4651	4,998	19,159	317	19,476
5	Allis Chalmers	3522	4,998	-1,764	1,524	-240
4	American Airlines	4511	5,014	2,616	1,168	3,784
6	Callahan Mining	9998	4,998	2,499	0	2,499
5	Fedders	3430	4,998	-714	3,424	2,710
5	Franklin Stores	5311	5,000	-1,000	1,845	845
8	General Acceptance	6140	4,998	2,142	3,602	5,744
5	Giant Yellownife	1042	4,998	833	4,840	5,673
2	Grinnell	3430	5,031	12,126	2,203	14,329
2	Heinz (H. J.)	2030	4,998	3,822	2,781	6,603
8	Industrial Acceptance	6140	5,005	2,310	3,534	5,844
2	International Salt	2800	4,995	-3,780	246	-3,534
6	I T E Circuit Breaker	3610	5,016	2,717	1,218	3,935
2	Lane Bryant	5600	4,998	10,710	4,191	14,901
2	Monsanto	2800	4,991	1,449	1,660	3,109
8	National Airlines	4511	4,994	14,528	440	14,968

TABLE 56 (Continued)

PORTFOLIO G 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Pabst Brewing	2082	4,998	21,420	2,099	23,519
3	Prentice Hall	2700	5,000	32,500	2,363	34,863
2	Quaker Oats	2000	4,980	-332	1,980	1,348
4	Waukesha Motors	3560	4,992	0	3,190	3,190
	Total:		100,000	121,241	42,325	163,566

TABLE 57

PORTFOLIO H 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Abbott Laboratories	2830	5,005	12,705	2,784	15,489
2	Addressograph Mimeograph	3570	4,980	7,470	2,293	9,763
3	Air Products & Chemicals	2800	5,004	8,340	396	8,736
5	Allied Products	3449	5,016	627	694	1,321
1	Avon Products	2844	5,000	96,250	6,325	102,575
3	British Petroleum	2913	4,998	1,428	1,742	3,170
4	Burroughs	3570	5,031	6,321	1,290	7,611
4	Cenco Instruments	3811	5,000	83,500	5,475	87,975
6	Cherry Burrell	3449	5,005	4,620	1,097	5,717
3	Colgate-Palmolive	2841	5,000	12,500	4,681	17,181
4	Evans Products	0800	4,998	3,213	1,007	4,220
3	Hall (W. F.) Printing	2731	4,992	1,872	3,057	4,929
5	Jaeger Machine	3531	5,016	-2,717	1,731	-986
4	Kelsey Hayes	3714	5,016	1,140	2,383	3,523
5	Mansfield Tire & Rubber	3000	4,998	714	2,792	3,506
4	Murphy (G. W.) Industries	3533	5,000	0	786	786

TABLE 57 (Continued)

PORTFOLIO H 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Potlatch Forests	0800	4,992	-2,392	946	-1,446
2	Simplicity Pattern	2700	5,000	18,000	3,020	21,020
4	United Shoe Machinery	3550	4,961	1,452	3,297	4,749
4	Westinghouse Air Brake	3740	4,988	172	2,365	2,537
	Total:		100,000	245,215	48,161	302,376

TABLE 58

PORTFOLIO I 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Abbott Laboratories	2830	5,005	12,705	2,784	15,489
2	Armstrong Cork	2510	5,010	11,022	3,183	14,205
4	Diamond International	2650	4,998	5,880	2,858	8,738
3	Fafnir Bearing	3569	4,991	4,774	3,978	8,752
3	Hammond	3999	4,998	588	3,940	4,528
4	Hoover	3630	5,000	16,250	6,375	22,625
5	Island Creek Coal	1211	4,968	-1,656	1,512	-144
2	Johns Manville	2950	4,998	-102	2,066	1,964
4	Massey-Fergusson	3522	4,998	9,996	3,606	13,602
3	Moore	2761	4,998	882	709	1,591
8	National Airlines	4511	5,005	14,560	441	15,001
3	National Steel	3310	5,031	129	2,300	2,429
4	Purolator Products	3714	4,990	12,974	3,887	16,861
4	Republic Steel	3310	4,980	-1,743	2,086	343
2	Simplicity Pattern	2700	5,000	18,000	3,020	21,020
3	Square D Company	3622	4,998	8,568	3,434	12,002

TABLE 58 (Continued)

PORTFOLIO I 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Stone Container	2650	4,998	7,854	2,870	10,724
2	Sunbeam	3630	5,016	5,225	1,866	7,091
5	U. S. Pipe & Foundry	3312	5,018	-1,737	2,316	579
3	Wickes	3522	5,000	17,500	5,675	23,175
	Total:		100,000	141,669	58,906	200,575

TABLE 59

PORTFOLIO J 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Company Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Amerada Petroleum	1311	5,015	1,530	1,380	2,910
4	American Airlines	4511	4,991	2,604	1,163	3,667
4	American Distilling	2085	5,005	8,190	4,363	12,553
5	Campbell Red Lake Mines	1042	4,998	11,162	3,432	14,594
4	Chrysler	3711	5,015	4,130	2,074	6,204
3	Container Corporation of America	2650	4,997	2,104	2,646	4,750
4	Continental Baking	2051	4,980	-1,162	1,801	639
6	Duquesne Brewing	2082	4,998	833	3,707	4,540
4	Duval	1477	5,032	4,080	1,802	5,882
8	Heller (Walter E.)	6140	5,000	7,500	4,863	12,363
4	Kaiser Aluminum	3334	5,016	-438	992	554
5	Keebler	2052	4,984	-712	2,145	1,433
1	Kellogg	2000	5,000	18,125	4,813	22,938
4	Koppers	2800	5,016	-912	1,677	765
5	Montgomery Ward	5322	4,978	-2,358	1,801	-557
5	Penn-Dixie Cement	3241	5,000	-3,625	1,481	-2,144

TABLE 59 (Continued)

PORTFOLIO J 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Company Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
1	Plough	2830	5,000	33,750	3,350	37,100
3	Rayonier	0800	4,984	890	1,501	2,391
3	Rexall	2800	5,000	26,250	2,800	29,050
2	Rex Chainbelt	3531	4,991	1,953	2,220	4,173
	Total:		100,000	113,894	50,011	163,905

TABLE 60

PORTFOLIO K 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	American Crystal Sugar	2063	5,004	834	3,090	3,924
5	American Motors	3711	5,000	10,000	16,325	26,325
4	Amsted Industries	3740	4,991	3,472	3,439	6,911
1	Anchor Hocking Glass	3221	4,986	9,418	3,656	13,074
1	Avon Products	2844	5,000	96,250	6,325	102,575
4	Clevite	3714	4,986	5,817	3,753	9,570
4	De Vilbiss	3550	5,000	5,000	3,910	8,910
6	Duquesne Brewing	2082	5,004	834	3,711	4,545
4	Flintkote	2950	5,016	-1,140	2,709	1,569
3	Goodrich	3000	5,032	-884	1,503	619
2	Grinnell	3430	4,992	12,032	2,186	14,218
4	Interstate Department Stores	5311	5,000	27,500	3,200	30,700
1	Kellogg	2000	5,000	18,125	4,813	22,938
4	Lone Star Brewing	2082	5,004	1,668	3,182	4,850
3	Medusa Portland Cement	3241	4,988	-1,032	1,780	748
5	National Sugar Refining	2062	5,016	-2,888	1,269	-1,619

TABLE 60 (Continued)

PORTFOLIO K 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Newberry	5331	4,991	-2,415	1,913	-502
4	Purex	2899	5,001	26,672	5,718	32,390
5	St. Joseph Lead	1031	4,991	3,255	2,541	5,796
3	Tecumseh Products	3430	4,998	1,071	2,889	3,960
	Total:		100,000	213,589	77,912	291,501

TABLE 61

PORTFOLIO L 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Admiral	3651	2,502	12,093	158	9,749
7	Alleghany Airlines	4511	2,499	8,330	92	8,422
8	Allen Electric Equipment	3714	2,500	18,750	638	19,388
7	American Beverage	2086	2,501	12,505	0	12,505
4	American Enka	2823	2,496	9,152	2,608	11,760
5	American Motors	3711	2,500	5,000	8,123	13,163
8	Avco	3721	2,496	6,656	2,708	9,364
6	Avis Industrial	3679	2,500	8,750	938	9,688
8	Baldwin (D. H.)	3931	2,496	7,072	2,147	9,219
5	Braniff Airways	4511	2,496	26,624	703	27,327
3	British Petroleum	2913	2,506	716	874	1,590
4	Brown Forman	2085	2,500	23,750	2,713	26,463
6	Callahan Mining	9998	2,502	1,251	0	1,251
4	Cenco Instruments	3811	2,500	41,250	2,738	43,988
5	Cooper Tire & Rubber	3000	2,502	10,842	3,144	13,986
5	Crompton & Knowles	3550	2,500	4,500	2,505	7,005

TABLE 61 (Continued)

PORTFOLIO L 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Crown Cork & Seal	3221	2,500	38,364	0	38,364
4	Electrolux	3630	2,502	10,842	3,645	14,487
8	Ethyl	2899	2,502	24,186	1,476	25,662
8	Gren Giant	2030	2,500	11,500	2,320	13,820
8	Grumman Aircraft Engineering	3721	2,505	3,340	870	4,210
8	Gulf & Western Industries	9998	2,500	80,000	750	80,750
5	Hamilton Watch	3871	2,502	2,919	1,213	4,132
6	Hat Corporation of America	2300	2,500	1,500	750	2,250
8	Heller (Walter E.)	6140	2,500	3,750	2,431	6,181
4	Hoover	3630	2,500	8,125	3,188	11,313
4	Host International	5812	2,500	37,500	4,175	41,675
5	Indian Head	2200	2,500	42,500	4,000	46,500
4	International Silver	3999	2,499	4,641	953	5,594
8	Kennametal	3399	2,493	6,371	1,033	7,404
5	Leesona	3550	2,500	10,000	1,388	11,388
8	McGraw-Hill	2731	2,496	5,200	751	5,951

TABLE 61 (Continued)

PORTFOLIO L 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
1	Magnavox	3651	2,502	28,356	2,619	30,975
8	National Airlines	4511	2,497	7,264	220	7,484
5	Northwest Airlines	4511	2,500	71,875	1,719	73,594
5	Pittsburgh Brewing	2082	2,502	5,004	2,177	7,181
7	Publicker	2085	2,500	500	0	500
3	Prentice-Hall	2700	2,500	16,250	1,181	17,431
2	Simplicity Pattern	2700	2,500	9,000	1,510	10,510
2	Xerox	3570	2,502	62,630	1,968	164,598
	Total:		100,000	786,356	70,466	856,822

TABLE 62

PORTFOLIO M 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	3,333	11,110	122	11,232
8	Allen Electric Equipment	3714	3,332	24,990	850	25,840
7	American Beverage	2086	3,333	16,665	0	16,665
4	American Enka	2823	3,336	12,232	3,486	15,718
5	American Motors	3711	3,332	6,664	10,879	17,543
8	Avco	3721	3,330	8,880	3,613	12,493
6	Avis Industrial	3679	3,332	11,662	1,250	12,912
8	Baldwin (D. H.)	3931	3,336	9,452	2,869	12,321
3	British Petroleum	2913	3,332	952	1,161	2,113
4	Brown Forman	2085	3,332	31,554	3,615	35,269
4	Cenco Instruments	3811	3,332	54,978	3,649	58,627
5	Crompton Knowles	3550	3,335	6,003	3,342	9,345
8	Crown Cork & Seal	3221	3,333	51,106	0	51,106
4	Electrolux	3630	3,333	14,443	4,855	19,298
8	Ethyl	2899	3,333	32,219	1,966	34,185
8	Green Giant	2030	3,335	15,341	3,095	18,436

TABLE 62 (Continued)

PORTFOLIO M 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Grumman Aircraft Engineering	3721	3,330	4,440	1,157	5,597
8	Gulf & Western Industries	9998	3,333	106,656	1,000	107,656
6	Hat Corporation of America	2300	3,335	2,001	1,001	3,002
8	Heller (Walter E.)	6140	3,332	4,998	3,240	8,238
4	Hoover	3630	3,332	10,829	4,248	15,077
4	Host International	5812	3,333	49,995	5,566	55,561
5	Indian Head	2200	3,333	56,661	5,333	61,994
4	International Silver	3999	3,339	6,201	1,274	7,475
8	Kennametal	3399	3,339	8,533	1,384	9,917
5	Leesona	3550	3,332	13,328	1,849	15,177
8	National Airlines	4511	3,333	9,696	294	9,990
5	Pittsburgh Brewing	2082	3,333	6,666	2,900	9,566
3	Prentice-Hall	2700	3,332	21,658	1,574	23,232
7	Publicker	2085	3,335	667	0	667
	Total:		100,000	610,680	75,572	686,252

TABLE 63

PORTFOLIO N 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	3,570	11,900	131	12,031
8	Allen Electric Equipment	3714	3,570	26,775	910	27,685
7	American Beverage	2086	3,571	17,855	0	17,855
5	American Motors	3711	3,570	7,140	11,656	18,796
8	Avco	3721	3,570	9,520	3,873	13,393
6	Avis Industrial	3679	3,570	12,495	1,339	13,834
8	Baldwin (D. H.)	3931	3,570	10,115	3,070	13,185
3	British Petroleum	2913	3,570	1,020	1,244	2,264
4	Brown Forman	2085	3,570	33,915	3,873	37,788
4	Cenco Instruments	3811	3,570	58,905	3,909	62,814
5	Crompton & Knowles	3550	3,570	6,426	3,577	10,003
8	Crown Cork & Seal	3221	3,570	54,740	0	54,740
4	Electrolux	3630	3,570	15,470	5,200	20,670
8	Ethyl	2899	3,570	34,510	2,106	36,616
8	Green Giant	2030	3,575	16,445	3,318	19,763
8	Grumman Aircraft Engineering	3721	3,570	4,760	1,240	6,000

TABLE 63 (Continued)

PORTFOLIO N 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Gulf & Western Industries	9998	3,571	114,272	1,071	115,343
8	Heller (Walter E.)	6140	3,572	5,358	3,474	8,832
4	Hoover	3630	3,572	11,609	4,554	16,163
4	Host International	5812	3,571	53,565	5,964	59,529
5	Indian Head	2200	3,571	60,707	5,714	66,421
4	International Silver	3999	3,577	6,643	1,364	8,007
8	Kennametal	3399	3,573	9,131	1,481	10,612
5	Leesona	3550	3,572	14,288	1,982	16,270
8	National Airlines	4511	3,575	10,400	315	10,715
5	Pittsburgh Brewing	2082	3,573	7,146	3,109	10,255
3	Prentice-Hall	2700	3,572	23,218	1,688	24,906
7	Publicker	2085	3,575	715	0	715
	Total:		100,000	639,043	76,162	715,205

TABLE 64

PORTFOLIO O 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	3,999	13,330	147	13,477
8	Allen Electric Equipment	3714	4,000	30,000	1,020	31,020
7	American Beverage	2086	4,000	20,000	0	20,000
5	American Motors	3711	4,000	8,000	13,060	21,060
6	Avis Industrial	3679	4,000	14,000	1,500	15,500
8	Baldwin (D. H.)	3931	4,002	11,339	3,442	14,781
3	British Petroleum	2913	3,997	1,142	1,393	2,535
4	Brown Forman	2085	4,000	38,000	4,340	42,340
4	Cenco Instruments	3811	4,000	66,000	4,380	70,380
5	Crompton & Knowles	3550	4,000	7,200	4,008	11,208
8	Crown Cork & Seal	3221	3,999	61,318	0	61,318
4	Electrolux	3630	3,999	17,329	5,825	23,154
8	Ethyl	2899	3,999	38,657	2,359	41,016
8	Green Giant	2030	4,000	18,400	3,712	22,112
8	Gulf & Western Industries	9998	4,000	128,000	1,200	129,200
8	Heller (Walter E.)	6140	4,000	6,000	3,890	9,890

TABLE 64 (Continued)

PORTFOLIO O 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Hoover	3630	4,000	13,000	5,100	18,100
4	Host International	5812	4,000	60,000	6,680	66,680
5	Indian Head	2200	4,000	68,000	6,400	74,400
4	International Silver	3999	3,997	7,423	1,525	8,948
8	Kennametal	3399	4,005	10,235	1,660	11,895
5	Leesona	3550	4,000	16,000	2,220	18,220
8	National Airlines	4511	4,004	11,648	353	12,001
5	Pittsburgh Brewing	2082	3,999	7,998	3,479	11,477
7	Publicker	2085	4,000	800	0	800
	Total:		100,000	673,819	77,693	751,512

TABLE 65

PORTFOLIO P 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	4,998	16,660	183	16,843
8	Allen Electric Equipment	3714	5,000	37,500	1,275	38,775
7	American Beverage	2086	5,000	25,000	0	25,000
5	American Motors	3711	5,000	10,000	16,325	26,325
6	Avis Industrial	3679	5,000	17,500	1,875	19,375
8	Baldwin (D. H.)	3931	4,998	14,161	4,298	18,459
3	British Petroleum	2913	5,005	1,430	1,745	3,175
4	Cenco Instruments	3811	5,000	82,500	5,475	87,975
5	Crompton & Knowles	3550	5,000	9,000	5,010	14,010
8	Crown Cork & Seal	3221	4,998	76,636	0	76,636
8	Ethyl	2899	4,998	48,314	2,949	51,263
8	Green Giant	2030	5,000	23,000	4,640	27,640
8	Gulf & Western Industries	9998	5,000	160,000	1,500	161,500
8	Heller (Walter E.)	6140	5,000	7,500	4,863	2,363
4	Host International	5812	5,000	75,000	8,350	83,350
5	Indian Head	2200	5,000	85,000	8,000	93,000

TABLE 65 (Continued)

PORTFOLIO P 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Leesona	3550	5,000	20,000	2,775	22,775
8	National Airlines	4511	5,005	14,560	441	15,001
5	Pittsburgh Brewing	2082	4,998	9,996	4,348	14,344
7	Publicker	2085	5,000	1,000	0	1,000
	Total:		100,000	734,757	74,052	808,809

TABLE 66

PORTFOLIO Q 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
1	Avon Products	2844	5,000	96,250	6,325	102,575
4	Belden	3400	5,008	626	1,768	2,394
2	Black & Decker	3550	4,996	11,350	2,370	13,720
4	Burlington Industries	2200	4,998	15,708	4,327	20,035
1	Bristol-Myers	2830	4,998	34,272	2,770	37,042
1	Chesebrough Pond's	2844	5,000	24,000	3,990	27,990
3	Coca-Cola Bottling NY	2086	4,992	3,744	3,561	7,305
8	Collins Radio	3670	4,992	6,144	355	6,499
1	Consolidated Cigars	2121	5,000	13,000	6,800	19,800
7	Curtis Publishing	2700	5,000	1,250	875	2,125
8	GAF	2800	4,995	6,105	389	6,494
8	General Finance	6145	5,004	5,004	4,014	9,018
5	Giant Yellowknife	1042	5,004	834	4,846	5,680
3	Gimbel Brothers	5311	5,005	2,695	1,990	4,685
2	Lane Bryant	5600	5,005	10,725	4,197	14,922
5	Parker Hannifin	3560	5,000	45,000	5,925	50,925

TABLE 66 (Continued)

PORTFOLIO Q 1957-1966 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Rohr	3725	5,004	4,170	2,719	6,889
8	Talcott (James)	6140	5,000	4,375	5,356	9,731
8	Thiokol Chemical	3721	5,000	13,000	250	13,250
1	Zenith	3651	5,001	75,015	10,535	85,550
	Total:		100,000	373,267	73,362	446,629

APPENDIX F

Equal Shares Strategy

In the tables which follow, an initial investment of $100,000 is assumed to be made in dollar amounts of each security sufficient to purchase an approximately equal number of shares of each security, subject to the constraint of the available funds, in each of the seventeen portfolios, A through Q, inclusive, on the first business day of 1957 and liquidated on the last business day of 1966.

The tables indicate the risk class of each portfolio security, the name of the issuing company, the COMPUSTAT industry number, the initial investment, the capital gain from that investment, the dividend income received during the holding period from that investment, and the total return from that investment (capital gain plus dividend income).

Portfolio totals indicate the total initial investment, the total capital gain, the total dividend income, and the total (holding period) return.

TABLE 67

PORTFOLIO A 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Anheuser Busch	2082	5,769	32,050	5,147	37,197
1	Avon Products	2844	2,564	49,357	3,243	52,600
4	Bausch & Lomb	3831	5,128	33,973	3,724	37,697
5	Braniff Airways	4511	3,846	41,024	1,083	42,107
1	Bristol Myers	2830	4,487	30,768	2,487	33,255
1	Eastman Kodak	2800	13,461	68,587	7,211	75,798
4	Emerson Electric	3610	4,487	33,973	4,352	38,325
4	Emery Airfreight	4511	3,205	55,126	3,147	58,273
4	Fairchild Camera	3670	3,205	46,793	1,699	48,492
3	General Tire	3721	3,846	17,307	2,622	19,929
3	Lorillard	2111	5,128	21,153	14,076	35,229
2	Motorola	3651	8,333	51,280	4,340	55,620
1	Merck	2830	6,410	42,947	4,660	47,607
5	Northwest Airlines	4511	2,568	73,830	1,765	75,595
1	Plough	2830	5,128	34,614	3,436	38,050
4	Polaroid	3861	3,846	98,073	500	98,573

TABLE 67 (Continued)

PORTFOLIO A 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Richardson Merrell	2830	8,333	41,665	5,416	47,081
2	Tampax	2600	6,410	71,792	8,250	80,042
2	Xerox	3570	1,923	124,995	1,513	126,508
1	Zenith	3561	1,923	28,845	4,051	32,896
	Total:		100,000	998,152	82,722	1,080,874

TABLE 68

PORTFOLIO B 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Alpha Portland Cement	3241	4,588	3,596	1,378	-2,218
4	Bath Industries	3731	6,765	5,289	1,140	-4,149
3	Borg Warner	3714	5,580	3,224	1,293	-1,931
5	Bullard	3540	3,198	1,230	332	-898
8	Colt Industries	3560	3,720	1,488	0	-1,488
7	C F & I Steel	3310	3,596	2,108	337	-1,771
7	Cudahy	2010	1,364	496	0	-496
8	Curtis-Wright	3721	5,704	3,596	1,829	-1,767
5	Foote Mineral	1000	4,836	1,860	455	-1,405
4	General Portland Cement	3241	4,216	3,100	1,579	-1,521
2	International Salt	2800	13,653	10,332	2,584	-7,748
5	Lehigh Portland Cement	3241	5,580	4,464	1,265	-3,199
4	Lone Star Cement	3241	4,464	2,604	1,333	-1,271
8	New York Shipbuilding	3721	5,828	3,968	868	-3,100
7	Pittsburgh Steel	3310	4,464	3,348	122	-3,226
4	Potlatch Forest	0800	5,952	2,852	1,128	-1,724

TABLE 68 (Continued)

PORTFOLIO B 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
6	Rath Packing	2010	3,224	2,480	508	-1,972
6	Steep Rock Iron Mines	1000	2,604	1,984	145	-1,839
7	Walworth	3430	2,108	1,116	250	-866
5	Wheeling Steel	3310	8,556	6,572	2,201	-4,371
	Total:		100,000	65,707	18,747	-46,960

TABLE 69

PORTFOLIO C 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	Allied Chemical	2800	4,747	-1,515	1,667	152
4	American Can	3221	4,141	606	2,040	2,646
5	American Radiator	3430	1,717	202	867	1,069
1	American Telephone & Telegraph	4811	2,958	2,652	1,806	4,458
2	American Tobacco	2111	1,818	1,313	1,372	2,785
3	Atchinson Topeka Santa Fe	4011	2,525	303	1,540	1,843
1	Borden	2020	1,414	1,717	873	2,590
3	Columbia Gas System	4924	1,818	808	1,136	1,944
3	Consolidated Edison NY	4911	2,323	909	1,546	2,455
1	DuPont	2800	19,493	-4,949	6,868	1,919
1	Eastman Kodak	2800	2,121	10,807	1,136	11,943
1	General Electric	3600	6,120	2,958	2,152	5,110
4	International Harvester	3522	1,919	1,616	1,248	2,864
2	Mobil Oil	2913	2,828	1,919	1,256	3,175
1	National Biscuit	2052	1,818	3,030	1,451	4,481
1	Otis Elevator	3550	2,244	1,632	1,560	3,192

TABLE 69 (Continued)

PORTFOLIO C 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Pacific Gas & Electric	4911	1,616	2,020	988	3,008
6	Pennsylvania Railroad	4011	2,121	3,232	864	4,096
1	Procter & Gamble	2841	2,525	4,848	1,406	6,254
1	Sears, Roebuck	5322	1,414	3,131	852	3,983
1	Standard Oil of California	2913	4,343	1,717	1,831	3,548
1	Standard Oil of New Jersey	2913	5,959	404	2,626	3,030
2	Union Carbide	2800	5,858	-1,111	1,858	747
2	Union Electric	4911	1,414	1,212	938	2,150
2	Union Pacific Railroad	4011	2,828	1,010	1,707	2,717
4	United States Steel	3310	7,474	-3,737	2,611	-1,126
4	Westinghouse Electric	3600	2,929	1,919	1,182	3,101
3	Woolworth	5331	1,515	505	895	1,400
	Total:		100,000	39,158	46,376	85,534

TABLE 70

PORTFOLIO D 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Alcoa	3334	6,808	-1,036	959	-107
3	Allied Chemical	2800	3,478	-1,110	1,221	111
4	American Can	3221	3,075	450	1,515	1,965
1	American Telephone & Telegraph	4811	2,146	1,924	1,311	3,235
2	American Tobacco	2111	1,332	962	1,078	2,040
5	Anaconda	3331	5,328	-2,368	1,092	-1,276
4	Bethlehem Steel	3310	3,700	-1,554	1,516	-38
4	Chrysler	3711	1,258	1,036	520	1,556
1	DuPont	2800	14,668	-3,724	5,168	1,444
1	Eastman Kodak	2800	1,554	7,918	833	8,751
1	General Electric	3600	4,440	2,146	1,561	3,707
1	General Foods	2000	1,628	3,700	1,225	4,925
2	General Motors	3711	3,256	1,628	2,350	3,978
2	Goodyear	2000	1,850	1,258	706	1,964
4	International Harvester	3522	1,406	1,184	915	2,099
3	International Nickel	1000	3,922	2,590	1,521	4,111

TABLE 70 (Continued)

PORTFOLIO D 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	International Paper	2600	2,220	-370	761	391
2	Johns Manville	2950	3,626	-74	1,499	1,425
2	Owens Illinois Glass	3221	2,294	1,702	940	2,642
1	Proctor & Gamble	2841	1,850	3,552	1,030	4,582
1	Sears, Roebuck	5322	1,036	2,294	625	2,919
1	Standard Oil of California	2913	3,225	1,275	1,360	2,635
1	Standard Oil of New Jersey	2913	4,366	296	1,924	2,220
4	Swift	2010	2,812	1,184	686	-498
1	Texaco	2913	1,998	3,330	1,260	4,590
2	Union Carbide	2800	4,292	-814	1,362	548
8	United Aircraft	3721	3,700	2,368	1,115	3,483
4	United States Steel	3310	5,476	-2,738	1,913	-825
4	Westinghouse Electric	3600	2,146	1,406	866	2,272
3	Woolworth	5331	1,110	370	656	1,026
	Total:		100,000	26,417	39,458	65,875

TABLE 71

PORTFOLIO E 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	Air Reduction	2800	4,335	-1,530	1,057	-473
4	Alcoa	3334	7,820	-1,190	1,067	-123
3	Allied Chemical	2800	3,995	-1,275	1,403	128
1	American Telephone & Telegraph	4811	2,465	2,210	1,505	3,715
2	American Tobacco	2111	1,530	1,105	1,238	2,243
4	Bethlehem Steel	3310	4,250	-1,785	1,741	-44
2	Caterpillar Tractor	3531	1,275	1,700	534	2,234
4	Chrysler	3711	1,445	1,190	598	1,788
1	DuPont	2800	16,212	-4,116	5,712	1,596
1	Eastman Kodak	2800	1,785	9,095	956	10,051
1	General Electric	3600	5,100	2,465	1,794	4,259
2	General Motors	3711	3,696	1,848	2,667	4,515
3	Goodrich	3000	6,216	-1,092	1,856	764
3	Ingersoll Rand	3560	3,655	-340	1,700	1,360
4	International Harvester	3522	1,615	1,360	1,051	2,411
3	International Nickel	1000	4,505	2,975	1,748	4,723

TABLE 71 (Continued)

PORTFOLIO E 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Johns Manville	2950	4,165	-85	1,721	1,636
4	Kennecott Copper	3331	3,655	-425	1,438	1,013
8	McDonnell Douglas	3721	170	1,870	150	2,020
2	Penney	5311	2,295	2,295	1,288	3,583
1	Sears, Roebuck	5322	1,190	2,635	717	3,352
1	Standard Oil of New Jersey	2313	5,015	340	2,210	2,550
2	Union Carbide	2800	4,930	-935	1,564	629
4	United States Steel	3310	6,216	-3,108	2,171	-937
4	Westinghouse Electric	3600	2,465	1,615	995	2,610
	Total:		100,000	16,822	38,881	55,703

TABLE 72

PORTFOLIO F 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	Air Reduction	2800	3,060	-1,080	746	-334
4	Alcoa	3334	5,428	-826	740	-86
4	American Smelting & Refining	1000	1,740	1,800	920	2,720
1	American Telephone & Telegraph	4811	1,740	1,560	1,063	2,623
2	Caterpillar Tractor	3531	900	1,200	377	1,577
4	Chrysler	3711	1,020	840	422	1,262
4	Continental Can	3221	1,920	600	783	1,383
2	Continental Oil	2912	3,717	472	1,117	1,589
1	Corn Products	2046	900	1,740	731	2,471
2	Dow Chemical	2800	3,599	59	873	932
1	DuPont	2800	11,387	-2,891	4,012	1,121
1	Eastman Kodak	2800	1,260	6,420	675	7,095
1	General Electric	3600	3,540	1,711	1,245	2,956
2	General Motors	3711	2,596	1,298	1,873	3,171
3	Ingersoll Rand	3560	2,580	-240	1,200	960
2	Inland Steel	3310	1,980	-120	1,010	890

TABLE 72 (Continued)

PORTFOLIO F 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	Insurance Company of No. America	6333	2,820	1,920	984	2,904
1	International Business Machines	3570	3,599	17,759	1,121	18,880
4	International Harvester	3522	1,140	960	742	1,702
3	International Nickel	1000	3,180	2,100	1,234	3,334
4	Kennecott Copper	3331	2,530	-300	1,015	715
4	Liggett & Myers	2111	3,835	0	2,994	2,994
2	Monsanto Chemical	2800	1,860	540	619	1,159
2	Owens Illinois Glass	3221	1,860	1,380	762	2,142
[illegible]	Parke-Davis	2830	960	660	691	1,351
1	Procter & Gamble	2841	1,500	2,880	835	3,715
4	Pullman	3740	1,860	720	1,194	1,914
3	Radio Corporation of America	3600	600	1,980	268	2,248
1	Reynolds (R. J.)	2111	840	1,200	859	2,059
1	Sears, Roebuck	5323	840	1,860	506	2,366
1	Standard Oil of New Jersey	2913	3,540	240	1,560	1,800
1	Texaco	2913	1,593	2,655	1,005	3,660

TABLE 72 (Continued)

PORTFOLIO F 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Union Carbide	2800	3,480	-660	1,104	444
2	Union Pacific Railroad	4011	1,680	600	1,014	1,614
8	United Aircraft	3721	3,000	1,920	904	2,824
3	United States Gypsum	2950	3,420	-60	1,818	1,758
3	United States Rubber	3000	1,440	900	649	1,549
4	United States Steel	3310	4,366	-2,183	1,525	-658
4	Westinghouse Electric	3600	1,740	1,140	702	1,842
3	Woolworth	5331	900	300	531	831
	Total:		100,000	51,054	42,423	93,477

TABLE 73

PORTFOLIO G 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Admiral	3651	1,368	5,244	8,664	13,908
5	Allis Chalmers	3522	7,752	-2,736	2,364	-372
4	American Airlines	4511	5,244	2,736	1,222	3,958
6	Callahan Mining	9998	1,368	684	0	684
5	Fedders	3430	3,192	-456	2,187	1,731
5	Franklin	5311	2,280	-456	841	385
8	General Acceptance	6140	3,192	1,368	2,300	3,668
5	Giant Yellownife Mines	1042	1,368	228	1,325	1,553
2	Grinnell	3430	8,892	21,432	3,894	25,326
2	H. J. Heinz	2030	3,859	2,951	2,147	5,098
8	Industrial Acceptance	6140	2,951	1,362	2,084	3,446
2	International Salt	2800	25,308	-19,152	4,793	-14,359
6	I T E Circuit Breaker	3610	5,472	2,964	1,329	4,293
2	Lane Bryant	5600	1,596	3,420	1,338	4,758
2	Monsanto	2800	7,068	2,052	2,351	4,403
8	National Airlines	4511	2,508	7,296	221	7,517

TABLE 73 (Continued)

PORTFOLIO G 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Pabst Brewing	2082	1,596	6,840	670	7,510
3	Prentice-Hall	2700	912	5,928	431	6,359
2	Quaker Oats	2000	6,810	-454	2,297	1,943
4	Waukesha Motor	3560	7,264	0	4,642	4,642
	Total:		100,000	41,251	45,100	86,351

TABLE 74

PORTFOLIO H 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Abbott Laboratories	2830	3,406	8,646	1,894	10,540
2	Addressograph Mimeograph	3570	5,240	7,860	2,413	10,273
3	Air Products & Chemicals	2800	3,144	5,240	249	5,489
5	Allied Products	3449	6,288	786	870	1,656
1	Avon Products	2844	1,048	20,174	1,326	21,500
3	British Petroleum	2913	1,834	524	639	1,163
4	Burroughs	3570	10,257	12,887	2,630	15,517
4	Cenco Instruments	3811	524	8,646	574	9,220
6	Cherry Burrell	3449	3,046	3,144	747	3,891
3	Colgate-Palmolive	2841	2,096	5,240	1,952	7,202
4	Evans Products	0800	3,682	2,367	742	3,109
3	Hall (W. F.) Printing	2731	6,288	2,358	3,851	6,209
5	Jaeger Machine	3531	6,288	-3,406	2,169	-1,237
4	Kelsey Hayes	3714	5,764	1,310	2,738	4,048
5	Mansfield Tire & Rubber	3000	1,841	263	1,028	1,291
4	Murphy (G. W.) Industries	3533	6,550	0	1,030	1,030

TABLE 74 (Continued)

PORTFOLIO H 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Potlatch Forests	0800	12,624	-6,049	2,393	-3,656
2	Simplicity Pattern	2700	1,310	4,716	791	5,507
4	United Shoe Machinery	3550	10,783	3,156	7,167	10,323
4	Westinghouse Air Brake	3740	7,627	263	3,616	3,879
	Total:		100,000	78,125	38,829	116,954

TABLE 75

PORTFOLIO I 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Abbott Laboratories	2830	3,185	8,085	1,771	9,856
2	Armstrong Cork	2510	3,675	8,085	2,335	10,420
4	Diamond International	2650	4,148	4,880	2,372	7,252
3	Fafnir Bearing	3569	5,335	5,390	4,491	9,881
3	Hammond	3999	4,148	488	3,270	3,758
4	Hoover	3630	976	3,172	1,244	4,416
5	Island Creek Coal	1211	13,230	-4,410	4,028	-382
2	Johns Manville	2950	11,956	244	4,941	4,697
4	Massey-Fergusson	3522	1,708	3,416	1,232	4,648
3	Moore	2751	4,148	732	588	1,320
8	National Airlines	4511	2,684	7,808	237	8,045
3	National Steel	3310	9,555	245	4,368	4,613
4	Purolator Products	3714	2,440	6,344	1,901	8,245
4	Republic Steel	3310	14,700	-5,145	6,157	1,012
2	Simplicity Pattern	2700	1,220	4,392	737	5,129
3	Square D Company	3622	1,708	2,928	1,174	4,102

TABLE 75 (Continued)

PORTFOLIO I 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Stone Container	2650	1,708	2,684	981	3,665
2	Sunbeam	3630	5,856	6,100	2,179	8,279
5	U. S. Pipe & Foundry	3312	6,344	-2,196	2,928	732
3	Wickes	3522	976	3,416	1,108	4,524
	Total:		100,000	56,170	48,042	104,212

TABLE 76

PORTFOLIO J 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Amerada Petroleum	1311	12,626	3,852	3,473	7,325
4	American Airlines	4511	4,899	2,556	1,142	3,698
4	American Distilling	2085	2,343	3,834	2,043	5,877
5	Campbell Red Lake Mines	1042	1,278	2,982	878	3,860
4	Chrysler	3711	3,621	2,982	1,497	4,479
3	Container Corporation of America	2650	4,066	1,712	2,153	3,865
4	Continental Baking	2051	6,420	-1,498	2,322	824
6	Duquesne Brewing	2082	1,284	214	952	1,166
4	Duval	1477	7,918	6,420	2,836	9,256
8	Heller (Walter E.)	6140	852	1,278	829	2,107
4	Kaiser Aluminum	3334	9,844	-856	1,947	1,091
5	Keebler	2052	5,964	-852	2,567	1,715
1	Kellogg	2000	1,712	6,206	1,648	7,854
4	Koppers	2800	7,062	-1,284	2,360	1,076
5	Montgomery Ward	5322	8,132	-3,852	2,943	-909
5	Penn-Dixie Cement	3241	8,560	-6,206	2,536	-3,670

TABLE 76 (Continued)

PORTFOLIO J 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
1	Plough	2830	1,704	1,502	1,142	12,644
3	Rayonier	0800	5,964	1,065	1,796	2,861
3	Rexall	2800	852	4,473	477	4,950
2	Rex Chainbelt	3531	4,899	1,917	2,179	4,096
	Total:		100,000	36,445	37,720	74,165

TABLE 77

PORTFOLIO K 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	American Crystal Sugar	2063	2,904	484	1,793	2,277
5	American Motors	3711	486	972	1,587	2,559
4	Amsted Industries	3740	5,566	3,872	3,836	7,708
1	Anchor Hocking Glass	3221	4,356	8,228	3,194	11,422
1	Avon Products	2844	972	18,711	1,230	19,941
4	Clevite	3714	4,374	5,103	3,293	8,396
4	De Vilbiss	3550	2,430	2,430	1,900	4,330
6	Duquesne	2082	1,452	242	1,080	1,322
4	Flintkote	2950	5,324	-1,210	2,875	1,665
3	Goodrich	3000	17,908	-3,146	5,348	2,202
2	Grinnell	3430	9,438	22,748	4,133	26,881
4	Interstate Department Stores	5311	968	5,324	620	5,944
1	Kellogg	2000	1,944	7,047	1,871	8,918
4	Lone Star Brewing	2082	2,916	972	1,854	2,826
3	Medusa Portland Cement	3241	7,018	1,452	2,505	1,053
5	National Sugar Refining	2062	7,986	-4,598	2,021	-2,577

TABLE 77 (Continued)

PORTFOLIO K 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Newberry	5331	7,502	-3,630	2,875	-755
4	Purex	2899	726	3,872	830	4,702
5	St. Joseph Lead	1031	5,566	3,630	2,834	6,464
3	Tecumseh Products	3430	10,164	2,178	5,876	8,054
	Total:		100,000	71,777	51,555	123,332

TABLE 78

PORTFOLIO L 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Admiral	3651	3,228	12,374	204	12,578
7	Alleghany Airlines	4511	1,614	5,380	59	5,439
8	Allen Electric Equipment	3714	1,076	8,070	274	8,344
7	American Beverage	2086	538	2,690	0	2,690
4	American Enka	2823	3,228	11,836	3,373	15,209
5	American Motors	3711	1,076	2,152	3,513	5,665
8	Avco	3721	3,228	8,608	3,502	12,110
6	Avis Industrial	3679	1,076	3,766	404	4,170
8	Baldwin (D. H.)	3931	3,228	9,146	2,776	11,922
5	Braniff Airways	4511	3,228	34,432	909	35,341
3	British Petroleum	2913	3,759	1,074	1,310	2,384
4	Brown Forman	2085	1,074	10,203	1,165	11,368
6	Callahan Manufacturing	9998	3,228	1,614	0	1,614
4	Cenco Instruments	3811	1,076	17,754	1,178	18,932
5	Cooper Tire & Rubber	3000	1,614	6,994	2,028	9,022
5	Crompton & Knowles	3550	2,690	4,842	2,695	7,537

TABLE 78 (Continued)

PORTFOLIO L 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Crown Cork & Seal	3221	1,614	24,748	0	24,748
4	Electrolux	3630	1,614	6,994	2,351	9,345
8	Ethyl	2899	1,614	15,602	952	16,554
8	Green Giant	2030	2,690	12,374	2,496	14,870
8	Grumman Aircraft Engineering	3721	8,055	10,740	2,798	13,538
8	Gulf & Western Industries	9998	538	17,216	161	17,377
5	Hamilton Watch	3871	3,228	3,766	1,566	5,332
6	Hat Corporation of America	2300	2,690	1,614	807	2,421
8	Heller (Walter E.)	5140	2,152	3,228	2,093	5,321
4	Hoover	3630	2,152	6,994	2,744	9,738
4	Host International	5812	538	8,070	898	8,968
5	Indian Head	2200	538	9,146	861	10,007
4	International Silver	3999	3,759	6,981	1,434	8,415
8	Kennametal	3399	4,833	12,351	2,003	14,354
5	Leesona	3550	2,152	8,608	1,194	9,802
8	McGraw-Hill	2731	6,444	13,425	1,939	15,364

TABLE 78 (Continued)

PORTFOLIO L 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
1	Magnavox	3651	1,614	18,292	1,689	19,981
8	National Airlines	4511	2,907	17,184	521	17,705
5	Northwest Airlines	4511	2,152	61,870	1,480	63,350
5	Pittsburgh Brewing	2082	1,614	3,228	1,404	4,632
3	Prentice-Hall	2700	2,152	13,988	1,017	15,005
7	Publicker	2085	2,685	537	0	537
2	Simplicity Pattern	2700	2,690	9,684	1,625	11,309
2	Xerox	3570	1,614	104,910	1,270	106,180
	Total:		100,000	532,485	56,693	589,178

TABLE 79

PORTFOLIO M 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	2,274	7,580	83	7,663
8	Allen Electric Equipment	3714	1,514	11,355	386	11,741
7	American Beverage	2086	758	3,790	0	3,790
4	American Enka	2823	4,548	16,676	4,753	21,429
5	American Motors	3711	1,516	2,032	4,950	7,982
8	Avco	3721	4,542	12,112	4,928	17,040
6	Avis Industrial	3679	1,516	5,306	569	5,875
8	Baldwin (D. H.)	3931	4,542	12,869	3,906	16,775
3	British Petroleum	2913	5,299	1,523	1,847	3,370
4	Brown Forman	2085	1,516	14,402	1,645	16,047
4	Cenco Instruments	3811	1,516	25,014	1,660	26,674
5	Crompton & Knowles	3550	3,790	6,822	3,798	10,620
8	Crown Cork & Seal	3221	2,274	34,868	0	34,868
4	Electrolux	3630	2,274	9,854	3,312	13,166
8	Ethyl	2899	2,274	21,982	1,342	23,324
8	Green Giant	2030	3,790	17,434	3,517	20,951

TABLE 79 (Continued)

PORTFOLIO M 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Grumman Aircraft Engineering	3721	11,355	15,140	3,944	19,084
9	Gulf & Western Industries	9998	758	24,256	227	24,483
6	Hat Corporation of America	2300	3,790	2,274	1,137	3,411
9	Heller (Walter E.)	6140	3,032	4,548	2,949	7,497
4	Hoover	3630	3,032	9,854	3,866	13,720
4	Host International	5812	758	11,370	1,266	12,636
5	Indian Head	2200	758	12,886	1,213	14,099
4	International Silver	3999	5,306	9,854	2,024	11,878
9	Kennametal	3399	6,813	17,411	2,824	20,235
5	Leesona	3550	3,032	12,128	1,683	13,811
9	National Airlines	4511	8,327	24,224	734	24,958
5	Pittsburgh Brewing	2082	2,274	4,548	1,978	6,526
3	Prentice-Hall	2700	3,032	19,708	1,433	21,141
7	Publicker	2085	3,790	758	0	758
	Total:		100,000	373,578	61,974	435,552

TABLE 80

PORTFOLIO N 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	2,81	8,270	91	8,361
8	Allen Electric Equipment	3714	1,654	12,405	422	12,827
7	American Beverage	2086	827	4,135	0	4,135
5	American Motors	3711	1,654	3,308	5,400	8,708
8	Avco	3721	4,962	13,232	5,384	18,616
6	Avis Industrial	3679	1,654	5,789	620	6,409
8	Baldwin (D. H.)	3931	4,962	14,059	4,267	18,326
3	British Petroleum	2913	5,782	1,652	2,015	3,667
4	Brown Forman	2085	1,654	15,713	1,795	17,508
4	Cenco Instruments	3811	1,654	27,291	1,811	29,102
5	Crompton & Knowles	3550	4,130	7,434	4,138	11,572
8	Crown Cork & Seal	3221	2,481	38,042	0	38,042
4	Electrolux	3630	2,481	10,751	3,614	14,365
8	Ethyl	2899	2,481	23,983	1,464	25,447
8	Green Giant	2030	4,130	18,998	3,833	22,831
8	Grumman Aircraft Engineering	3721	12,390	16,520	4,303	20,823

TABLE 80 (Continued)

PORTFOLIO N 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Gulf & Western Industries	9998	827	26,464	248	26,712
8	Heller (Walter E.)	6140	3,308	4,962	3,217	8,179
4	Hoover	3630	3,308	10,751	4,218	14,969
4	Host International	5812	827	12,405	1,381	13,786
5	Indian Head	2200	827	14,059	1,323	15,382
4	International Silver	3999	5,782	10,738	2,205	12,943
8	Kennametal	3399	7,434	18,998	3,081	22,079
5	Leesona	3550	3,308	13,232	1,836	15,068
8	National Airlines	4511	9,086	26,432	801	27,233
5	Pittsburgh Brewing	2082	2,478	4,956	2,156	7,112
3	Prentice Hall	2700	3,308	21,502	1,563	23,065
7	Publicker	2085	4,130	826	0	826
	Total:		100,000	386,907	61,186	448,093

TABLE 81

PORTFOLIO O 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	3,126	10,420	115	10,535
8	Allen Electric Equipment	3714	2,084	15,630	531	16,161
7	American Beverage	2086	1,042	5,210	0	5,210
5	American Motors	3711	2,084	4,168	6,804	10,972
6	Avis Industrial	3679	2,084	7,294	782	8,076
8	Baldwin (D. H.)	3931	6,252	17,714	5,377	23,091
3	British Petroleum	2913	7,294	2,084	2,542	4,626
4	Brown Forman	2085	2,084	19,798	2,261	22,059
4	Cenco Instruments	3811	2,084	34,386	2,282	36,668
5	Crompton & Knowles	3550	5,210	9,378	5,220	14,598
8	Crown Cork & Seal	3221	3,126	47,931	0	47,932
4	Electrolux	3630	3,126	13,546	4,554	18,100
8	Ethyl	2899	3,126	30,218	1,844	32,062
8	Green Giant	2030	5,210	23,966	4,835	28,801
8	Gulf & Western Industries	9998	1,042	33,344	313	33,657
8	Heller (Walter E.)	6140	4,168	6,252	4,053	10,305

TABLE 81 (Continued)

PORTFOLIO O 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Hoover	3630	4,168	13,546	5,314	18,860
4	Host International	5812	1,042	15,630	1,740	17,370
5	Indian Head	2200	1,042	17,714	1,667	19,381
4	International Silver	3999	7,294	13,546	2,782	16,328
8	Kennametal	3309	9,369	23,943	3,883	27,826
5	Leesona	3550	4,164	16,656	2,311	18,967
8	National Airlines	4511	11,451	33,312	1,010	34,322
5	Pittsburgh Brewing	2082	3,123	6,246	2,717	8,963
7	Publicker	2085	5,205	1,041	0	1,041
	Total:		100,000	422,974	62,937	485,911

TABLE 82

PORTFOLIO P 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	4,224	14,080	155	14,235
8	Allen Electric Equipment	3714	2,816	21,120	718	21,838
7	American Beverage	2086	1,408	7,040	0	7,040
5	American Motors	3711	2,816	5,632	9,194	14,826
6	Avis Industrial	3679	2,816	9,856	1,056	10,912
8	Baldwin (D. H.)	3931	8,454	23,953	7,270	31,223
3	British Petroleum	2913	9,813	2,818	3,438	6,256
4	Cenco Instruments	3811	2,816	46,464	3,084	49,548
5	Crompton & Knowles	3550	7,040	12,672	7,054	19,726
8	Crown Cork & Seal	3221	4,224	64,768	0	64,768
8	Ethyl	2899	4,224	40,832	2,492	43,324
8	Green Giant	2030	7,040	32,384	6,533	38,917
8	Gulf & Western Industries	9998	1,408	45,056	422	45,478
8	Heller (Walter E.)	6140	5,632	8,448	5,477	13,925
4	Host International	5812	1,408	21,120	2,351	23,471
5	Indian Head	2200	1,408	23,936	2,253	26,189

TABLE 82 (Continued)

PORTFOLIO P 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Leesona	3550	5,632	22,528	3,126	25,654
8	National Airlines	4511	15,499	45,088	1,367	46,455
5	Pittsburgh Brewing	2082	4,227	8,454	3,677	12,131
7	Publicker	2085	7,045	1,409	0	1,409
	Total:		100,000	457,658	59,667	517,325

TABLE 83

PORTFOLIO Q 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
1	Avon Products	2844	2,260	43,505	2,859	46,364
4	Belden	3400	9,040	1,130	3,192	4,322
2	Black & Decker	3550	6,215	14,125	2,949	17,074
4	Burlington Industries	2200	3,955	12,430	3,424	15,854
1	Bristol-Myers	2830	3,955	27,120	2,192	29,312
1	Chesebrough Pond's	2844	2,825	13,560	2,254	15,814
3	Coca-Cola Bottling NY	2086	6,780	5,085	4,836	9,921
8	Collins Radio	2670	14,690	18,080	1,045	19,125
1	Consolidated Cigars	2121	2,825	7,345	3,842	11,187
7	Curtis Publishing	2700	4,520	1,130	791	1,921
2	Lane Bryant	5600	3,955	8,475	3,317	11,792
8	GAF	2800	5,085	6,215	396	6,611
8	General Finance	6145	5,085	5,085	4,079	9,164
5	Giant Yellowknife	1042	3,390	565	3,283	3,848
3	Gimbel Brothers	5311	7,345	3,955	2,921	6,876
5	Parker Hannifin	3560	2,260	20,340	2,678	23,018

TABLE 83 (Continued)

PORTFOLIO Q 1957-1966 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Rohr	3725	6,780	5,650	3,684	9,334
8	Talcott (James)	6140	4,520	3,955	4,842	8,797
8	Thiokol Chemical	3721	2,820	7,332	141	7,473
1	Zenith	3651	1,695	25,425	3,571	28,996
	Total:		100,000	230,507	56,296	286,803

APPENDIX G

Equal Dollar Strategy

In the tables which follow, an initial investment of $100,000 is assumed to be made in equal dollar amounts in each security of each of the seventeen portfolios, A through Q, inclusive, on the first business day of 1958 and liquidated on the last business day of 1967.

The tables indicate the risk class of each portfolio security, the name of the issuing company, the COMPUSTAT industry number, the initial investment, the capital gain from that investment, the dividend income received during the holding period from that investment, and the total return from that investment (capital gain plus dividend income).

Portfolio totals indicate the total initial investment, the total capital gain, the total dividend income, and the total (holding period) return.

TABLE 84

PORTFOLIO A 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	American Enka	2823	5,001	65,013	12,352	77,365
1	Avon Products	2844	5,000	172,500	7,913	180,413
1	Bristol-Myers	2830	5,000	87,500	5,825	93,325
8	Crown Cork & Seal	3221	5,001	96,686	0	96,686
8	Ethyl	2899	5,000	90,000	5,775	95,775
3	Factor, Max	2844	5,000	73,750	5,475	79,225
4	Fairchild Camera	3670	5,001	141,695	5,118	146,813
8	Gulf & Western Industries	9998	5,000	290,000	2,700	292,700
3	Hart Schaffner & Marx	2300	4,998	69,972	8,113	78,085
4	Host International	5812	5,000	260,000	10,000	270,000
5	Indian Head	2200	5,000	97,500	5,325	102,825
4	International Silver	3999	5,000	77,500	7,675	85,175
5	Leesona	3550	5,000	100,000	6,550	106,650
1	Magnavox	3651	5,000	95,000	9,575	104,575
5	Northwest Airlines	4511	5,001	140,028	5,418	145,446
3	Prentice-Hall	2700	5,000	82,500	5,950	88,450

TABLE 84 (Continued)

PORTFOLIO A 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Simplicity Pattern	2700	5,000	117,500	8,625	126,125
4	Textron	3622	4,998	81,634	5,781	87,415
4	U. S. Freight	4210	5,000	85,000	7,350	92,350
2	Xerox	3570	5,000	752,500	8,925	761,425
	Total:		100,000	2,976,278	134,445	3,110,723

TABLE 85

PORTFOLIO B 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Aerojet General	3521	4,995	0	648	648
5	Alpha Portland Cement	3241	4,992	-2,486	1,881	-615
8	Associates Investments	6140	4,998	-1,617	1,962	345
6	J. I. Case	3522	4,992	0	0	0
1	DuPont	2800	5,106	-493	1,928	1,435
6	Endicott Johnson	3141	4,991	-483	805	322
5	Foote Mineral	1000	4,995	-540	429	-111
4	General Portland Cement	3241	4,992	-2,288	2,367	79
7	General Plywood	0800	4,992	-1,664	0	-1,664
5	Lehigh Portland Cement	3241	5,016	-3,432	1,294	-2,138
4	Lone Star Cement	3241	4,984	-1,780	1,896	116
4	Marquette Cement	3241	4,992	-2,304	2,938	634
2	National Lead	2800	4,992	-1,560	1,690	130
4	National Sugar	2062	4,991	-2,576	942	-1,634
8	New York Shipbuilding	3731	4,992	-2,304	1,075	-1,229
7	Pittsburgh Steel	3310	4,998	-357	0	-357

TABLE 85 (Continued)

PORTFOLIO B 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
6	Rath Packing	2010	5,004	-2,502	856	-1,646
6	Steep Rock Iron Mines	1000	5,000	-1,875	894	-981
3	Superior Oil	1311	5,010	-630	215	-415
5	Wheeling Steel	3310	4,970	-2,414	2,037	-377
	Total:		100,000	-31,315	23,857	-7,458

TABLE 86

PORTFOLIO C 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	Allied Chemical	2800	3,584	896	1,902	2,798
4	American Can	3221	3,567	957	1,775	2,732
5	American Standard	3430	3,570	2,550	2,168	4,718
1	American Telephone & Telegraph	4811	3,556	2,794	2,338	5,132
2	American Tobacco	2111	3,572	2,444	2,843	5,287
3	Atchinson Topeka Santa Fe	4011	3,580	0	8,775	8,775
1	Borden	2020	3,570	4,760	2,175	6,935
3	Columbia Gas System	4924	3,568	2,453	2,703	5,156
3	Consolidated Edison NY	4911	3,591	931	2,056	2,987
1	DuPont	2800	3,520	-340	1,330	990
1	Eastman Kodak	2800	3,576	18,625	1,904	20,529
1	General Electric	3600	3,596	1,972	1,259	3,231
4	International Harvester	3522	3,575	6,325	3,289	9,614
2	Mobil Oil	2913	3,552	2,812	1,930	4,742
1	National Biscuit	2052	3,570	3,740	2,596	6,336
1	Otis Elevator	3550	3,600	4,140	2,932	7,072

TABLE 86 (Continued)

PORTFOLIO C 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Pacific Gas & Electric	4911	3,568	4,237	2,281	6,518
6	Pennsylvania Railroad	4011	3,570	9,450	2,121	11,571
1	Proctor & Gamble	2841	3,584	8,192	1,932	10,124
1	Sears, Roebuck	5322	3,562	12,056	2,463	14,519
1	Standard Oil of California	2913	3,572	2,350	1,793	4,143
1	Standard Oil of New Jersey	2913	3,550	1,278	1,931	3,209
2	Union Carbide	2800	3,552	25	1,358	1,383
2	Union Electric	4911	3,570	3,060	2,458	5,518
2	Union Pacific Railroad	4011	3,576	0	7,733	7,733
4	United States Steel	3310	3,621	-751	1,768	1,017
4	Westinghouse Electric	3600	3,552	4,218	1,365	5,583
3	Woolworth	5331	3,576	3,874	2,691	6,565
	Total:		100,000	103,048	71,869	173,817

TABLE 87

PORTFOLIO D 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Alcoa	3334	3,300	1,155	721	1,876
3	Allied Chemical	2800	3,360	840	1,783	2,623
4	American Can	3221	3,362	902	1,673	2,575
1	American Telephone & Telegraph	4811	3,332	2,618	2,191	4,809
2	American Tobacco	2111	3,325	2,275	2,646	4,921
5	Anaconda	3331	3,320	4,482	2,533	7,015
4	Bethlehem Steel	3310	3,312	-276	1,801	1,525
4	Chrysler	3711	3,328	11,008	2,066	13,074
1	DuPont	2800	3,344	-323	1,264	941
1	Eastman Kodak	2800	3,336	17,375	1,776	19,151
1	General Electric	3600	3,286	1,802	1,150	2,952
1	General Foods	2000	3,335	6,815	2,603	9,418
2	General Motors	3711	3,332	4,704	3,288	7,992
2	Goodyear	3000	3,328	3,584	1,302	4,886
4	International Harvester	3522	3,328	5,888	3,062	8,950
3	International Nickel	1000	3,325	7,790	2,060	9,850

TABLE 87 (Continued)

PORTFOLIO D 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	International Paper	2600	3,328	640	1,379	2,019
2	Johns Manville	2950	3,344	1,496	1,800	3,296
2	Owens Illinois Glass	3221	3,360	3,136	1,434	4,570
1	Proctor & Gamble	2841	3,332	7,616	1,796	9,412
1	Sears, Roebuck	5322	3,328	11,264	2,301	13,565
1	Standard Oil of California	2913	3,344	2,200	1,678	3,878
1	Standard Oil of New Jersey	2913	3,300	1,188	1,795	2,983
4	Swift	2010	3,345	4,014	2,034	6,048
1	Texaco	2913	3,335	6,210	2,148	8,358
2	Union Carbide	2800	3,360	70	1,302	1,372
9	United Aircraft	3721	3,360	4,512	1,432	5,944
4	United States Steel	3310	3,315	-650	1,641	991
4	Westinghouse Electric	3600	3,360	3,990	1,292	5,282
3	Woolworth	5331	3,336	3,614	2,510	6,124
	Total:		100,000	119,939	56,461	176,400

TABLE 88

PORTFOLIO E 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	Air Reduction	2800	4,000	1,600	2,040	3,640
4	Alcoa	3334	4,020	1,407	878	2,285
3	Allied Chemical	2800	4,000	1,000	2,123	3,123
1	American Telephone & Telegraph	4811	3,976	3,124	2,614	5,738
2	American Tobacco	2111	3,990	2,730	3,175	5,905
4	Bethlehem Steel	3310	3,996	-333	2,173	1,840
2	Caterpillar Tractor	3531	4,000	13,200	2,832	16,032
4	Chrysler	3711	3,991	13,201	2,477	15,678
1	DuPont	2800	4,048	-391	1,530	1,139
1	Eastman Kodak	2800	4,008	20,875	2,134	23,009
1	General Electric	3600	3,968	2,176	1,389	3,565
2	General Motors	3711	3,978	5,616	3,925	6,441
3	Goodrich	3000	4,026	366	1,360	1,726
3	Ingersoll Rand	3560	4,012	1,180	2,360	3,540
4	International Harvester	3522	3,991	7,061	3,672	10,733
3	International Nickel	1000	4,025	9,430	2,493	11,923

TABLE 88 (Continued)

PORTFOLIO E 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Johns Manville	2950	3,990	1,785	2,147	3,932
4	Kennecott Copper	3331	4,004	3,234	2,606	5,840
8	McDonnell Douglas	3721	4,000	106,000	4,000	110,000
2	Penney	5311	3,976	5,396	2,205	7,601
1	Sears, Roebuck	5322	3,991	13,508	2,760	16,268
1	Standard Oil of New Jersey	2913	4,000	1,440	2,176	3,616
2	Union Carbide	2800	4,032	84	1,562	1,646
4	United States Steel	3310	3,978	-780	1,970	1,190
4	Westinghouse Electric	3600	4,000	4,750	1,538	6,288
	Total:		100,000	217,659	58,139	275,798

TABLE 89

PORTFOLIO F 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	Air Reduction	2800	2,500	1,000	1,275	2,275
4	Alcoa	3334	2,520	882	550	1,432
4	American Smelting & Refining	1000	2,484	7,590	2,461	10,051
1	American Telephone & Telegraph	4811	2,492	1,958	1,638	3,596
2	Caterpillar Tractor	3531	2,490	8,217	1,763	9,980
4	Chrysler	3711	2,496	8,256	1,549	9,805
4	Continental Can	3221	2,484	2,024	1,272	3,296
2	Continental Oil	2912	2,494	1,798	1,159	2,957
1	Corn Products	2046	2,496	3,900	2,048	5,948
2	Dow Chemicals	2800	2,499	1,938	808	2,746
1	DuPont	2800	2,464	-238	931	693
1	Eastman Kodak	2800	2,496	13,000	1,329	14,329
1	General Electric	3600	2,542	1,394	890	2,284
2	General Motors	3711	2,482	3,504	2,449	5,953
3	Ingersoll Rand	3560	2,482	730	1,460	2,190
2	Inland Steel	3310	2,496	768	1,664	2,432

TABLE 89 (Continued)

PORTFOLIO F 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Insurance Company of No. America	6333	2,496	1,144	978	2,122
1	International Business Machines	3570	2,546	21,280	868	22,145
4	International Harvester	3522	2,496	4,416	2,296	6,712
3	International Nickel	1000	2,520	5,904	1,561	7,465
4	Kennecott Copper	3331	2,496	2,016	1,624	3,640
4	Liggett & Myers	2111	2,508	152	1,929	2,081
2	Monsanto Chemicals	2800	2,494	1,548	951	2,499
2	Owens Illinois Glass	3221	2,490	2,324	1,062	3,386
2	Parke Davis	2930	2,500	875	1,531	2,406
1	Proctor & Gamble	2841	2,492	5,696	1,343	7,039
4	Pullman	3740	2,499	3,451	2,463	5,914
3	Radio Corporation of America	3600	2,504	14,085	1,521	15,606
1	Reynolds (R. J.)	2111	2,496	4,368	2,423	6,781
1	Sears, Roebuck	5322	2,496	8,448	1,726	10,174
1	Standard Oil of New Jersey	2913	2,500	900	1,360	2,260
1	Texaco	2913	2,523	4,698	1,625	6,323

TABLE 89 (Continued)

PORTFOLIO F 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Union Carbide	2800	2,496	52	967	1,019
2	Union Pacific Railroad	4011	2,504	0	5,415	5,415
8	Inited Aircraft	3721	2,520	3,384	1,074	4,458
3	United States Gypsum	2950	2,520	120	1,230	1,350
3	United States Rubber	3000	2,496	5,148	1,721	6,869
4	United States Steel	3310	2,499	-490	1,237	747
4	Westinghouse Electric	3600	2,496	2,964	959	3,923
3	Woolworth	5331	2,496	2,704	1,878	4,582
	Total:		100,000	151,908	62,988	214,896

TABLE 90

PORTFOLIO G 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Admiral	3651	4,998	26,656	1,050	27,706
5	Allis Chalmers	3522	5,014	28,34	2,043	4,877
4	American Airlines	4511	4,998	19,278	4,034	23,312
6	Callahan Mining	9998	4,998	24,990	0	24,990
5	Fedders	3430	4,994	16,344	4,218	20,562
5	Franklin Stores	5311	5,004	8,340	2,927	11,267
8	General Acceptance	6140	5,012	7,518	5,741	11,259
5	Giant Yellowmife Mines	1042	5,000	7,500	7,325	14,825
2	Grinnell	3430	4,992	26,844	2,844	28,896
2	H. J. Heinz	2030	4,002	9,984	3,145	13,129
8	Industrial Acceptance	6140	4,992	2,304	3,686	5,990
2	International Salt	2800	5,000	-800	1,990	1,190
6	I T E Circuit Breaker	3610	5,022	5,022	1,083	6,105
2	Lane Bryant	5600	4,998	20,825	5,714	26,539
2	Monsanto	2800	4,988	3,096	1,902	4,998
8	National Airlines	4511	4,998	53,312	1,799	55,111

TABLE 90 (Continued)

PORTFOLIO G 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Pabst Brewing	2082	5,000	59,000	3,750	62,750
3	Prentice-Hall	2700	5,000	3,520	409	3,929
2	Quaker Oats	2000	5,000	4,750	2,605	7,355
4	Waukesha Motor	3560	5,000	6,200	4,150	10,350
	Total:		100,000	306,725	58,415	365,140

TABLE 91

PORTFOLIO H 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Abbott Laboratories	2830	4,992	9,672	2,381	12,053
2	Addressograph Mimeograph	3570	4,998	13,804	2,387	16,191
3	Air Products & Chemicals	2800	5,005	10,780	389	11,169
5	Allied Products	3449	4,992	16,896	887	17,783
1	Avon Products	2844	5,000	87,500	5,825	93,325
3	British Petroleum	2913	5,000	3,750	3,288	7,038
4	Burroughs	3570	5,017	26,988	1,730	28,718
4	Cenco Instruments	3811	4,998	88,298	4,098	92,396
6	Cherry Burrell	3449	5,000	9,000	1,025	10,025
3	Colgate-Palmolive	2841	5,000	22,500	4,944	27,444
4	Evans Products	0800	4,998	17,493	2,099	19,592
3	Hall (W. F.) Printing	2731	4,998	5,236	3,558	8,794
5	Jaeger Machine	3531	4,995	333	2,544	2,877
4	Kelsey Hayes	3714	4,995	8,991	3,513	12,504
5	Mansfield Tire & Rubber	3000	4,998	12,495	3,099	15,594
4	Murphy (G. W.) Industries	3533	5,008	6,573	588	7,161

TABLE 91 (Continued)

PORTFOLIO H 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Potlatch Forests	0800	5,004	1,251	1,277	2,528
2	Simplicity Pattern	2700	5,000	117,500	8,625	126,125
4	United Shoe Machinery	3550	5,016	3,168	3,597	6,765
4	Westinghouse Air Brakes	3740	4,986	5,540	3,975	9,515
	Total:		100,000	467,768	59,829	527,597

TABLE 92

PORTFOLIO I 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Abbott Laboratories	2830	4,992	9,672	2,351	12,053
2	Armstrong Cork	2510	5,005	20,020	4,677	24,697
4	Diamond International	2650	4,992	11,520	4,059	15,579
3	Fafnir Bearing	3569	4,992	9,600	3,684	13,284
3	Hammond	3999	4,992	-624	4,040	3,416
4	Hoover	3630	5,002	42,517	14,681	57,198
5	Island Creek Coal	1211	5,000	3,500	2,010	5,510
2	Johns Manville	2950	5,016	2,244	2,699	4,943
4	Massey-Fergusson	3522	5,004	10,008	4,637	14,645
3	Moore	2761	5,000	22,000	2,650	24,650
8	National Airlines	4511	4,998	53,312	1,799	55,111
3	National Steel	3310	4,992	3,840	3,519	7,359
4	Purolator	3714	4,998	31,654	7,322	38,976
4	Republic Steel	3310	5,000	500	3,141	3,641
2	Simplicity Pattern	2700	5,000	117,500	8,625	126,125
3	Square D Company	3622	5,000	18,000	5,510	23,510

TABLE 92 (Continued)

PORTFOLIO I 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Stone Container	2650	5,004	8,340	1,785	10,125
2	Sunbeam	3630	5,016	5,643	1,944	7,587
5	U. S. Pipe & Foundry	3312	4,997	2,893	3,156	6,049
3	Wickes	3522	5,000	30,000	6,675	36,675
	Total:		100,000	402,139	88,994	491,133

TABLE 93

PORTFOLIO J 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Amerada Petroleum	1311	4,995	3,996	2,024	6,020
4	American Airlines	4511	4,998	19,278	4,034	23,312
4	American Distilling	2085	5,000	12,500	5,235	17,735
5	Campbell Red Lakes Mines	1042	5,000	-2,300	4,270	1,970
4	Chrysler	3711	5,005	16,555	3,107	19,662
3	Container Corporation of America	2650	5,004	3,892	2,880	6,772
4	Continental Baking	2051	4,995	8,325	3,680	12,005
6	Duquesne Brewing	2082	4,998	833	3,873	4,706
4	Duval	1477	5,000	35,750	3,350	39,100
8	Heller (Walter E.)	6140	5,000	10,000	5,125	15,125
4	Kaiser Aluminun	3334	5,014	5,668	2,006	7,674
5	Keebler	2052	4,991	3,542	1,892	5,434
1	Kellogg	2000	4,995	18,870	4,751	23,621
4	Koppers	2800	4,998	5,586	3,287	8,873
5	Montgomery Ward	5322	5,012	-537	2,238	1,701
5	Penn-Dixie Cement	3241	4,991	1,302	2,441	3,743

TABLE 93 (Continued)

PORTFOLIO J 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
1	Plough	2830	5,000	25,000	1,515	26,515
3	Rayonier	0800	4,998	5,236	2,278	7,514
3	Rexall	2800	4,998	54,978	3,798	58,776
2	Rex Chainbelt	3531	5,008	10,642	3,312	13,954
	Total:		100,000	239,116	65,096	304,212

TABLE 94

PORTFOLIO K 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	American Crystal Sugar	2063	4,998	-1,323	1,173	-150
5	American Motors	3711	5,002	27,511	16,332	43,843
4	Amsted Industries	3740	4,998	8,925	5,658	14,583
1	Anchor Hocking Glass	3221	5,000	6,000	3,400	9,400
1	Avon Products	2844	5,000	87,500	5,825	93,325
4	Clevite	3714	4,995	13,320	4,842	18,162
4	De Vilbiss	3550	5,000	10,500	4,145	14,645
6	Duquesne Brewing	2082	5,004	834	3,878	4,712
4	Flintkote	2950	5,000	-200	2,236	2,036
3	Goodrich	3000	5,016	456	1,695	2,151
2	Grinnell	3430	4,992	26,052	2,844	28,896
4	Interstate Department Stores	5311	4,998	54,978	3,782	58,760
1	Kellogg	2000	4,995	18,870	4,751	23,621
4	Lone Star Brewing	2082	4,995	3,885	4,329	8,214
3	Medusa Portland Cement	3241	5,004	3,336	2,961	6,297
5	National Sugar Refining	2062	4,991	-2,576	942	-1,634

TABLE 94 (Continued)

PORTFOLIO K 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Newberry	5331	5,000	600	2,078	2,678
4	Purex	2899	4,998	56,644	6,631	63,275
5	St. Joseph Lead	1031	4,998	9,282	4,748	14,030
3	Tecumseh Products	3430	5,016	6,726	2,916	9,642
	Total:		100,000	331,320	85,166	416,486

TABLE 95

PORTFOLIO L 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Admiral	3651	2,499	13,328	525	13,853
7	Alleghany Airlines	4511	2,500	16,250	138	16,388
8	Allen Electric Equipment	3714	2,500	20,000	188	20,188
7	American Beverage	2086	2,500	12,500	0	12,500
4	American Enka	2823	2,499	32,487	6,173	38,660
5	American Motors	3711	2,500	6,250	8,163	14,413
8	Avco	3721	2,502	24,603	3,173	27,776
6	Avis Industrial	3679	2,500	10,000	1,013	11,013
8	Baldwin (D. H.)	3931	2,500	20,000	3,819	23,819
5	Braniff Airways	4511	2,502	10,842	459	11,301
3	British Petroleum	2913	2,500	1,875	1,644	3,519
4	Brown Forman	2085	2,500	25,000	3,075	28,075
6	Callahan Mining	9998	2,499	12,495	0	12,495
4	Cenco Instruments	3811	2,500	19,375	1,475	20,850
5	Cooper Tire & Rubber	3000	2,499	22,491	3,765	26,256
5	Crompton & Knowles	3550	2,500	18,750	7,050	25,800

TABLE 95 (Continued)

PORTFOLIO L 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Crown Cork & Seal	3221	2,499	48,314	0	48,314
4	Electrolux	3630	2,500	27,500	6,150	33,650
8	Ethyl	2899	2,500	45,000	2,888	47,888
8	Green Giant	2030	2,500	14,475	3,294	17,669
8	Grumman Aircraft Engineering	3721	2,502	12,927	2,268	15,195
8	Gulf & Western Industries	9998	2,500	145,000	1,350	146,350
5	Hamilton Watch	3871	2,502	10,842	2,969	13,811
6	Hat Corporation of America	2300	2,499	5,831	1,250	7,081
8	Heller (Walter E.)	6140	2,500	5,000	2,563	7,363
4	Hoover	3630	2,500	21,250	7,338	28,588
4	Host International	5812	2,501	130,052	5,002	135,094
5	Indian Head	2200	2,500	48,750	2,663	51,413
4	International Silver	3999	2,500	38,750	3,838	42,588
8	Kennametal	3399	2,500	20,000	2,120	22,120
5	Leesona	3550	2,500	50,000	3,275	53,275
8	McGraw-Hill	2731	2,499	14,280	1,428	15,708

TABLE 95 (Continued)

PORTFOLIO L 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
1	Magnavox	3651	2,500	47,500	4,788	52,288
8	National Airlines	4511	2,499	26,656	900	27,556
5	Northwest Airlines	4511	2,499	69,972	2,707	72,679
5	Pittsburgh Brewing	2082	2,500	12,500	4,013	16,513
7	Publicker	2085	2,500	3,750	0	3,750
3	Prentice-Hall	2700	2,500	41,250	2,975	44,225
2	Simplicity Pattern	2700	2,500	58,750	4,313	63,063
2	Xerox	3570	2,500	376,250	4,463	380,713
	Total:		100,000	1,540,745	113,215	1,653,960

TABLE 96

PORTFOLIO M 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	3,332	21,658	183	21,841
8	Allen Electric Equipment	3714	3,332	26,656	250	26,906
7	American Beverage	2086	3,333	16,665	0	16,665
4	American Enka	2823	3,333	43,329	8,233	51,562
5	American Motors	3711	3,332	8,330	10,879	19,209
8	Avco	3721	3,336	32,804	4,231	37,035
6	Avis Industrial	3679	3,334	13,336	1,350	14,686
8	Baldwin (D. H.)	3931	3,336	26,688	5,096	31,784
3	British Petroleum	2913	3,336	2,502	2,193	4,695
4	Brown Forman	2085	3,334	33,340	4,101	37,441
4	Cenco Instruments	3811	3,336	25,854	1,927	27,781
5	Crompton & Knowles	3550	3,334	25,005	9,402	34,407
8	Crown Cork & Seal	3221	3,333	64,438	0	64,438
4	Electrolux	3630	3,332	36,652	8,197	44,849
8	Ethyl	2899	3,332	59,976	3,848	63,824
8	Green Giant	2030	3,336	19,182	4,395	23,577

TABLE 96 (Continued)

PORTFOLIO M 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Grumman Aircraft Engineering	3721	3,336	17,236	3,025	20,261
8	Gulf & Western Industries	9998	3,333	193,314	1,800	195,114
6	Hat Corporation of America	2300	3,333	7,777	1,667	9,444
8	Heller (Walter E.)	6140	3,332	6,664	3,415	10,079
4	Hoover	3630	3,332	28,322	9,559	38,101
4	Host International	5812	3,333	173,316	6,666	179,982
5	Indian Head	2200	3,332	64,974	3,549	68,523
4	International Silver	3999	3,332	51,646	5,115	56,761
8	Kennametal	3399	3,335	26,680	2,828	29,508
5	Leesona	3550	3,332	66,640	4,365	71,005
8	National Airlines	4511	3,333	113,322	3,600	116,922
5	Pittsburgh Brewing	2082	3,332	16,660	5,348	22,008
3	Prentice-Hall	2700	3,332	54,978	3,965	58,943
7	Publicker	2085	3,332	4,998	0	4,998
	Total:		100,000	1,282,942	119,407	1,402,349

TABLE 97

PORTFOLIO N 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	3,570	23,205	196	23,401
8	Allen Electric Equipment	3714	3,570	28,560	268	28,828
7	American Beverage	2086	3,571	17,855	0	17,855
5	American Motors	3711	3,570	8,925	11,656	20,581
8	Avco	3721	3,576	35,164	4,536	39,700
6	Avis Industrial	3679	3,570	14,280	1,446	15,726
8	Baldwin (D. H.)	3931	3,572	28,576	5,456	34,032
3	British Petroleum	2913	3,572	2,679	2,349	5,028
4	Brown Forman	2085	3,570	35,700	4,391	40,091
4	Cenco Instruments	3811	3,572	27,683	2,063	29,746
5	Crompton & Knowles	3550	3,570	26,775	10,067	36,842
8	Crown Cork & Seal	3221	3,570	69,020	0	69,020
4	Electrolux	3630	3,570	39,270	8,782	48,052
8	Ethyl	2899	3,570	64,260	4,123	68,383
8	Green Giant	2030	3,572	20,539	4,706	25,245
8	Grumman Aircraft Engineering	3721	3,576	18,476	3,242	21,718

TABLE 97 (Continued)

PORTFOLIO N 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Gulf & Western Industries	9998	3,571	207,118	1,928	209,046
8	Heller (Walter E.)	6140	3,572	7,144	3,661	10,805
4	Hoover	3630	3,570	30,345	10,378	40,823
4	Host International	5812	3,571	185,692	7,142	192,834
5	Indian Head	2200	3,572	69,654	3,804	73,458
4	International Silver	3999	3,572	55,366	5,483	60,849
8	Kennametal	3399	3,570	28,560	3,027	31,587
5	Leesona	3550	3,572	71,440	4,679	76,119
8	National Airlines	4511	3,573	38,112	1,286	39,398
5	Pittsburgh Brewing	2082	3,572	17,860	5,733	23,593
3	Prentice-Hall	2700	3,572	58,938	4,251	63,189
7	Publicker	2085	3,572	5,358	0	5,358
	Total:		100,000	1,236,554	114,753	1,351,307

TABLE 98

PORTFOLIO O 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	4,000	26,000	220	26,220
8	Allen Electric Equipment	3714	4,000	32,000	300	32,300
7	American Beverage	2086	4,000	20,000	0	20,000
5	American Motors	3711	4,000	10,000	13,060	23,060
6	Avis Industrial	3679	4,000	16,000	1,620	17,620
8	Baldwin (D. H.)	3931	4,000	32,000	6,110	38,110
3	British Petroleum	2913	4,000	3,000	2,630	5,630
4	Brown Forman	2085	4,000	40,000	4,920	44,920
4	Cenco Instruments	3811	4,000	31,000	2,310	33,310
5	Crompton & Knowles	3550	4,000	30,000	11,280	41,280
8	Crown Cork & Seal	3221	3,999	77,314	0	77,314
4	Electrolux	3630	4,000	44,000	9,840	53,840
8	Ethyl	2899	4,000	72,000	4,620	76,620
8	Green Giant	2030	4,000	23,000	5,270	28,270
8	Gulf & Western Industries	9998	4,000	232,000	2,160	234,160
8	Heller (Walter E.)	6140	4,000	8,000	4,100	12,100

TABLE 98 (Continued)

PORTFOLIO O 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Hoover	3630	4,000	34,000	11,740	45,740
4	Host International	5812	4,000	208,000	8,000	216,000
5	Indian Head	2200	4,000	78,000	4,260	82,260
4	International Silver	3999	4,000	62,000	6,140	68,140
8	Kennametal	3399	4,000	32,000	3,392	35,392
5	Leesona	3550	4,000	80,000	5,240	85,240
8	National Airlines	4511	3,999	42,656	1,440	44,096
5	Pittsburgh Brewing	2082	4,002	20,010	6,423	26,433
7	Publicker	2085	4,000	6,000	0	6,000
	Total:		100,000	1,258,980	115,075	1,374,075

TABLE 99

PORTFOLIO P 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	5,000	32,500	275	32,775
[illegible]	Allen Electric Equipment	3714	5,000	40,000	375	40,375
7	American Beverage	2086	5,000	25,000	0	25,000
5	American Motors	3711	5,000	12,500	16,325	28,825
6	Avis Industrial	3679	5,000	20,000	2,025	22,025
[illegible]	Baldwin (D. H.)	3931	5,000	40,000	7,638	47,638
3	British Petroleum	2913	5,000	3,650	3,288	7,038
4	Cenco Instruments	3811	5,000	38,750	2,950	41,700
5	Crompton & Knowles	3550	5,000	37,500	14,100	51,600
8	Crown Cork & Seal	3221	5,001	96,686	0	96,686
[illegible]	Ethyl	2899	5,000	90,000	5,775	96,775
8	Green Giant	2030	5,000	28,750	6,588	35,338
4	Gulf & Western Industries	9998	5,001	290,058	2,701	292,759
8	Heller (Walter E.)	6140	5,000	10,000	5,125	15,125
4	Host International	5812	5,000	260,000	10,000	270,000
5	Indian Head	2200	5,000	97,000	5,325	102,825

TABLE 99 (Continued)

PORTFOLIO P 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Leesona	3550	5,000	100,000	6,550	106,550
8	National Airlines	4511	4,998	53,312	1,799	55,111
5	Pittsburgh Brewing	2082	5,000	25,000	8,025	33,025
7	Publicker	2085	5,000	7,500	0	7,500
	Total:		100,000	1,308,806	98,864	1,470,670

TABLE 100

PORTFOLIO Q 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
1	Avon Products	2844	5,000	172,500	7,913	180,413
4	Belden	3400	4,998	29,155	5,165	34,320
2	Black & Decker	3550	4,998	39,984	4,940	44,924
4	Burlington Industries	2200	5,000	34,000	6,810	40,810
1	Bristol-Myers	2830	5,000	87,500	5,825	93,325
1	Chesebrough Pond's	2844	5,000	36,000	4,500	40,500
3	Coca-Cola Bottling NY	2086	5,004	7,784	5,165	12,949
8	Collins Radio	3670	5,004	50,040	1,212	51,252
1	Consolidated Cigars	2121	5,000	21,000	7,830	28,830
7	Curtis Publishing	2700	5,004	1,668	417	2,085
8	GAF	2800	5,004	7,784	612	8,396
8	General Finance	6145	5,000	5,000	3,910	8,910
5	Giant Yellownife	1042	5,000	7,500	7,325	14,825
3	Gimbel Brothers	5311	5,000	3,500	6,670	41,670
2	Lane Bryant	5600	4,998	20,825	5,714	26,539
5	Parker Hannifin	3560	5,000	67,500	7,013	74,513

TABLE 100 (Continued)

PORTFOLIO Q 1958-1967 RESULTS, EQUAL DOLLAR STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Rohr	3725	4,995	14,430	3,741	18,171
8	Talcott (James)	6140	4,995	7,215	5,006	12,221
8	Thiokol Chemical	3721	5,000	5,000	325	5,325
1	Zenith	3651	5,000	66,250	9,413	75,663
	Total:		100,000	716,125	99,506	815,641

APPENDIX H

Equal Shares Strategy

In the tables which follow, an initial investment of $100,000 is assumed to be made in dollar amounts of each security sufficient to purchase an approximately equal number of shares of each security, subject to the constraint of the available funds, in each of the seventeen portfolios, A through Q, inclusive, on the first business day of 1958 and liquidated on the last business day of 1967.

The tables indicate the risk class of each portfolio security, the name of the issuing company, the COMPUSTAT industry number, the initial investment, the capital gain from that investment, the dividend income received during the holding period from that investment, and the total return from that investment (capital gain plus dividend income).

Portfolio totals indicate the total initial investment, the total capital gain, the total dividend income, and the total (holding period) return.

TABLE 101

PORTFOLIO A 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	American Enka	2823	5,668	73,554	13,975	87,529
1	Avon Products	2844	7,544	260,268	11,938	272,206
1	Bristol-Myers	2830	7,544	132,020	8,789	140,809
8	Crown Cork & Seal	3221	5,661	109,446	0	109,446
8	Ethyl	2899	3,774	67,932	4,359	72,291
3	Factor, Max	2844	7,548	111,333	8,265	119,598
4	Fairchild Camera	3670	5,661	160,395	5,793	166,188
8	Gulf & Western Industries	9998	1,887	109,446	1,019	110,465
3	Hart Schaffner & Marx	2300	5,661	79,254	9,190	88,444
4	Host International	5812	1,887	98,124	3,774	101,898
5	Indian Head	2200	3,774	73,593	4,019	77,612
4	International Silver	3999	3,774	58,497	5,793	64,290
5	Leesona	3550	3,774	75,480	4,944	80,424
1	Magnavox	3651	3,774	71,706	7,227	78,933
5	Northwest Airlines	4511	5,661	158,508	6,133	164,641
3	Prentice-Hall	2700	3,774	62,271	4,491	66,762

TABLE 101 (Continued)

PORTFOLIO A 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Simplicity Pattern	2700	3,774	88,689	6,510	95,199
4	Textron	3622	5,661	92,463	6,548	99,011
4	U. S. Freight	4210	9,435	160,395	13,869	174,264
2	Xerox	3570	3,774	567,987	6,537	574,524
	Total:		100,000	2,611,361	133,173	2,744,534

TABLE 102

PORTFOLIO B 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Aerojet General	3721	3,105	0	403	403
5	Alpha Portland Cement	3241	2,990	-1,495	1,127	-368
8	Associates Investment	6140	3,910	-1,265	1,535	270
6	J. I. Case	3522	1,840	0	0	0
1	DuPont	2800	20,240	-1,955	7,648	5,693
6	Endicott Johnson	3141	3,565	-345	575	230
5	Foote Mineral	1000	4,255	-460	366	-94
4	General Portland Cement	3241	2,760	-1,265	1,309	44
7	General Plywood	0800	1,368	-456	0	-456
5	Lehigh Portland Cement	3241	4,332	-2,964	1,117	-1,847
4	Lone Star Cement	3241	3,220	-1,150	1,225	75
4	Marquette Cement	3241	2,990	-1,380	1,760	380
2	National Lead	2800	11,040	-3,450	3,738	288
4	National Sugar	2062	3,565	-1,840	673	-1,167
8	New York Shipbuilding	3731	2,990	-1,380	644	-736
7	Pittsburgh Steel	3310	1,610	-115	0	-115

TABLE 102 (Continued)

PORTFOLIO B 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
6	Rath Packing	2010	2,070	-1,035	354	-681
6	Steep Rock Iron Mines	1000	920	-345	164	-181
3	Superior Oil	1311	19,205	-2,415	822	-1,593
5	Wheeling Steel	3310	4,025	-1,955	1,650	-305
	Total:		100,000	-25,270	25,110	-160

TABLE 103

PORTFOLIO C 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	Allied Chemical	2800	3,680	920	1,953	2,873
4	American Can	3221	4,715	1,265	2,346	3,611
5	American Standard	3430	1,610	1,150	978	2,128
1	American Telephone & Telegraph	4811	3,220	2,530	2,117	4,647
2	American Tobacco	2111	2,185	1,495	1,739	3,234
3	Atchinson Topeka Santa Fe	4011	1,150	0	2,819	2,819
1	Borden	2020	1,740	2,320	1,060	3,380
3	Columbia Gas System	4924	1,840	1,265	1,394	2,659
3	Consolidated Edison NY	4911	3,105	805	1,778	2,583
1	DuPont	2800	20,240	-1,955	7,648	5,693
1	Eastman Kodak	2800	2,760	14,375	1,470	15,845
1	General Electric	3600	7,130	3,910	2,496	6,406
4	International Harvester	3522	1,495	2,645	1,375	4,020
2	Mobil Oil	2913	2,760	2,185	1,500	3,685
1	National Biscuit	2052	2,415	2,530	1,756	4,286
1	Otis Elevator	3550	2,300	2,645	1,873	4,518

TABLE 103 (Continued)

PORTFOLIO C 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Pacific Gas & Electric	4911	1,840	2,185	1,176	3,361
6	Pennsylvania Railroad	4011	1,955	5,175	1,162	6,337
1	Proctor & Gamble	2841	3,220	7,360	1,735	9,095
1	Sears, Roebuck	5322	1,495	5,060	1,034	6,094
1	Standard Oil of California	2913	4,370	2,875	2,193	5,068
1	Standard Oil of New Jersey	2913	5,800	2,088	3,155	5,243
2	Union Carbide	2800	5,520	115	2,139	2,254
2	Union Electric	4911	1,610	1,380	1,109	2,489
2	Union Pacific Railroad	4011	920	0	1,990	1,990
4	United States Steel	3310	5,865	-1,150	2,904	1,754
4	Westinghouse Electric	3600	3,680	4,370	1,415	5,785
3	Woolworth	5331	1,380	1,495	1,038	2,533
	Total:		100,000	69,038	55,532	124,390

TABLE 104

PORTFOLIO D 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Alcoa	3334	5,520	1,932	1,205	3,137
3	Allied Chemical	2800	2,944	736	1,562	2,298
4	American Can	3221	3,772	1,012	1,877	2,889
1	American Telephone & Telegraph	4811	2,576	2,024	1,694	3,718
2	American Tobacco	2111	1,748	1,196	1,391	2,587
5	Anaconda	3331	1,860	2,511	1,419	3,930
4	Bethlehem Steel	3310	3,312	-276	1,801	1,525
4	Chrysler	3711	1,196	3,956	742	4,698
1	DuPont	2800	16,192	-1,564	6,118	4,554
1	Eastman Kodak	2800	2,184	11,375	1,163	12,538
1	General Electric	3600	5,704	3,128	1,996	5,124
1	General Foods	2000	2,116	4,324	1,651	5,975
2	General Motors	3711	3,128	4,416	3,087	7,503
2	Goodyear	3000	2,392	2,576	936	3,512
4	International Harvester	3522	1,196	2,116	1,100	3,216
3	International Nickel	1000	3,220	7,544	1,995	9,539

TABLE 104 (Continued)

PORTFOLIO D 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	International Paper	2600	2,392	460	991	1,451
2	Johns Manville	2950	3,496	1,564	1,881	3,445
2	Owens Illinois Glass	3221	2,760	2,576	1,178	3,754
1	Proctor & Gamble	2841	2,576	5,888	1,388	7,276
1	Sears, Roebuck	5322	1,196	4,048	827	4,875
1	Standard Oil of California	2913	3,496	2,300	1,754	4,054
1	Standard Oil of New Jersey	2913	4,600	1,656	2,502	4,158
4	Swift	2010	1,380	1,656	839	2,495
1	Texaco	2913	2,668	4,968	1,719	6,687
2	Union Carbide	2800	4,416	92	1,711	1,803
3	United Aircraft	3721	3,220	4,324	1,373	5,697
4	United Steel	3310	4,692	- 920	2,323	1,403
4	Westinghouse Electric	3600	2,944	3,496	1,132	4,628
3	Woolworth	5331	1,104	1,196	831	2,027
	Total:		100,000	80,310	50,186	130,496

TABLE 105

PORTFOLIO E 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	Air Reduction	2800	2,625	1,050	1,339	2,389
4	Alcoa	3334	6,300	2,205	1,376	3,581
3	Allied Chemical	2800	3,360	840	1,783	2,623
1	American Telephone & Telegraph	4811	2,940	2,310	1,933	4,243
2	American Tobacco	2111	1,995	1,365	1,588	2,953
4	Bethlehem Steel	3310	3,780	-315	2,056	1,741
2	Caterpillar Tractor	3531	1,050	3,465	743	4,208
4	Chrysler	3711	1,365	4,515	847	5,362
1	DuPont	2800	18,480	-1,785	6,983	5,198
1	Eastman Kodak	2800	2,520	13,125	1,342	14,467
1	General Electric	3600	6,510	3,570	2,279	5,849
2	General Motors	3711	3,570	5,040	3,523	8,563
3	Goodrich	3000	6,930	630	2,342	2,972
3	Ingersoll Rand	3560	3,570	1,050	2,100	3,150
4	International Harvester	3522	1,365	2,415	1,256	3,671
3	International Nickel	1000	3,675	8,610	2,276	10,886

TABLE 105 (Continued)

PORTFOLIO E 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Johns Manville	2950	3,952	1,768	2,127	3,895
4	Kennecott Copper	3331	2,704	2,184	1,760	3,944
8	McDonnell Douglas	3721	208	5,512	208	5,720
2	Penney	5311	2,912	3,952	1,615	5,567
1	Sears, Roebuck	5322	1,365	4,620	944	5,564
1	Standard Oil of New Jersey	2913	5,200	1,872	2,829	4,701
2	Union Carbide	2800	4,992	104	1,934	2,038
4	United States Steel	3310	5,304	-1,040	2,626	1,586
4	Westinghouse Electric	3600	3,328	3,952	1,279	5,231
	Total:		100,000	71,014	49,088	120,102

TABLE 106

PORTFOLIO F 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
3	Air Reduction	2800	1,775	710	905	1,615
4	Alcoa	3334	4,260	1,491	930	2,421
4	American Smelting & Refining	1000	1,278	3,905	1,266	5,171
1	American Telephone & Telegraph	4811	1,988	1,562	1,307	2,689
2	Caterpillar Tractor	3531	700	2,310	496	2,806
4	Chrysler	3711	923	3,053	573	3,626
4	Continental Can	3221	1,917	1,562	982	2,544
2	Continental Oil	2912	3,053	2,201	1,419	3,620
1	Corn Products	2046	1,136	1,775	932	2,707
2	Dow Chemical	2800	3,479	2,698	1,125	3,823
1	DuPont	2800	12,496	-1,207	4,722	3,515
1	Eastman Kodak	2800	1,704	8,875	907	9,782
1	General Electric	3600	4,402	2,414	1,541	3,955
2	General Motors	3711	2,414	3,408	2,382	5,790
3	Ingersoll Rand	3560	2,414	710	1,420	2,130
2	Inland Steel	3310	1,846	568	1,230	1,798

TABLE 106 (Continued)

PORTFOLIO F 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Insurance Company of No. America	6333	3,408	1,562	1,335	2,897
1	International Business Machines	3570	4,757	39,760	1,621	41,381
4	International Harvester	3522	923	1,633	849	2,482
3	International Nickel	1000	2,485	5,822	1,539	7,361
4	Kennecott Copper	3331	1,846	1,491	1,201	2,692
4	Liggett & Myers	2111	4,686	284	3,603	3,887
2	Monsanto	2800	2,030	1,260	774	2,034
2	Owens Illinois Glass	3221	2,130	1,988	909	2,897
2	Parke Davis	2830	1,420	497	870	1,367
1	Proctor & Gamble	2841	1,988	4,544	1,071	5,615
4	Pullman	3740	1,491	2,059	1,470	3,529
3	Radio Corporation of America	3600	568	3,195	345	3,540
1	Reynolds (R. J.)	2111	1,136	1,988	1,103	3,091
1	Sears, Roebuck	5322	923	3,124	638	3,762
1	Standard Oil of New Jersey	2913	3,550	1,278	1,931	3,209
1	Texaco	2913	2,059	3,834	1,326	5,160

TABLE 106 (Continued)

PORTFOLIO F 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Compagny	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Union Carbide	2800	3,408	71	1,321	1,392
2	Union Pacific Railroad	4011	568	0	1,228	1,228
8	United Aircraft	3721	2,485	3,337	1,059	4,396
3	United States Gypsum	2950	4,473	213	2,183	2,396
3	United States Rubber	3000	1,136	2,343	783	3,126
4	United States Steel	3310	3,621	-710	1,793	1,083
4	Westinghouse Electric	3600	2,272	2,698	873	3,571
3	Woolworth	5331	852	923	641	1,564
	Total:		100,000	119,229	52,603	171,832

TABLE 107

PORTFOLIO G 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Admiral	3651	1,002	5,344	210	5,554
5	Allis Chalmers	3522	7,682	4,342	3,130	7,472
4	American Airlines	4511	2,338	9,018	1,887	10,905
6	Callahan Mining	9998	1,002	5,010	0	5,010
5	Fedders	3430	3,685	12,060	3,112	15,172
5	Franklin Stores	5311	2,010	3,350	1,176	4,526
8	General Acceptance	6140	4,676	7,014	3,490	10,504
5	Giant Yellowmife Mines	1042	1,336	2,004	1,957	3,961
2	Grinnell	3430	10,688	55,778	6,089	61,867
2	H. J. Heinz	2032	5,344	10,688	3,367	14,055
8	Industrial Acceptance	6140	4,342	2,004	3,206	5,210
2	International Salt	2800	16,700	-2,672	6,647	3,975
6	I T E Circuit Breaker	3610	9,045	9,045	1,950	10,995
2	Lane Bryant	5600	2,010	8,375	2,298	10,673
2	Monsanto	2800	9,715	6,030	3,705	9,735
8	National Airlines	4511	1,005	10,720	362	11,082

TABLE 107 (Continued)

PORTFOLIO C 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Pabst Brewing	2082	1,675	19,765	1,256	21,021
3	Prentice-Hall	2700	670	11,055	797	11,852
2	Quaker Oats	2000	6,700	6,365	3,491	9,856
4	Waukesha Motor	3560	8,375	10,385	6,951	17,336
	Total:		100,000	195,680	55,081	250,761

TABLE 108

PORTFOLIO H 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Abbott Laboratories	2830	5,440	10,540	2,594	13,134
2	Addressograph Mimeograph	3570	7,140	19,720	3,410	23,130
3	Air Products & Chemicals	2800	4,420	9,520	343	9,863
5	Allied Products	3449	4,420	14,960	785	15,745
1	Avon Products	2844	1,360	23,800	1,584	25,384
3	British Petroleum	2913	1,360	1,020	894	1,914
4	Burroughs	3570	9,860	53,040	3,400	56,440
4	Cenco Instruments	3811	1,020	18,020	836	18,856
6	Cherry Burrell	3449	3,400	6,120	697	6,817
3	Colgate Palmolive	2841	2,720	12,240	2,689	14,929
4	Evans Products	0800	2,040	7,140	857	7,997
3	Hall (W. F.) Printing	2731	7,140	7,480	5,083	12,563
5	Jaeger Machine	3531	5,100	340	2,598	2,938
4	Kelsey Hayes	3714	5,100	9,180	3,587	12,767
5	Mansfield Tire & Rubber	3000	2,040	5,100	1,265	6,365
4	Murphy (G. W.) Industries	3533	5,440	7,140	639	7,779

TABLE 108 (Continued)

PORTFOLIO H 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Potlatch Forests	0800	12,240	3,060	3,125	6,185
2	Simplicity Pattern	2700	682	16,027	1,176	17,203
4	United Shoe Machinery	3550	12,958	8,184	9,292	17,476
4	Westinghouse	3740	6,120	6,800	4,879	11,679
	Total:		100,000	239,431	49,733	289,164

TABLE 109

PORTFOLIO I 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Abbott Laboratories	2830	5,184	10,044	2,472	12,516
2	Armstrong Cork	2510	3,575	14,300	3,341	17,641
4	Diamond International	2650	4,225	9,750	3,435	13,185
3	Fafnir Bearing	3569	8,450	16,250	6,237	22,487
3	Hammond	3999	5,200	-650	4,209	3,559
4	Hoover	3630	650	5,525	1,908	7,433
5	Island Creek Coal	1211	12,960	9,072	5,210	14,282
2	Johns Manville	2950	12,350	5,525	6,646	12,171
4	Massey-Fergusson	3522	1,950	3,900	1,807	5,707
3	Moore	2761	1,625	7,150	861	8,011
8	National Airlines	4511	975	10,400	351	10,751
3	National Steel	3310	8,450	6,500	5,957	12,457
4	Purolator Products	3714	1,950	12,350	2,857	15,207
4	Republic Steel	3310	12,960	1,296	8,142	9,438
2	Simplicity Pattern	2700	650	15,275	1,121	16,396
3	Square D Company	3622	1,625	5,850	1,791	7,641

TABLE 109 (Continued)

PORTFOLIO I 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Stone Container	2650	1,950	3,250	696	3,946
2	Sunbeam	3630	7,800	8,775	3,023	11,798
5	U. S. Pipe & Foundry	3321	6,175	3,575	3,900	7,475
3	Wickes	3522	1,296	7,776	1,730	9,506
	Total:		100,000	155,913	65,694	221,607

TABLE 110

PORTFOLIO J 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
2	Amerada Petroleum	1311	13,860	11,088	5,615	16,703
4	American Airlines	4511	2,163	8,343	1,746	10,089
4	American Distilling	2085	3,080	7,700	3,225	10,925
5	Campbell Red Lake Mines	1042	1,545	6,798	1,319	8,117
4	Chrysler	3711	4,017	13,287	2,494	15,781
3	Container Corporation of America	2650	5,562	4,326	3,201	7,527
4	Continental Baking	2061	4,620	7,700	3,403	11,103
6	Duquesne Brewing	2082	1,854	309	1,437	1,746
4	Duval	1477	6,160	44,044	4,127	48,171
8	Heller (Walter E.)	6140	1,236	2,472	1,267	3,739
4	Kaiser Aluminum	3334	7,107	8,034	2,843	10,877
5	Keebler	2052	9,579	6,798	3,631	10,429
1	Kellogg	2000	2,781	10,506	2,645	13,151
4	Koppers	2800	5,253	5,871	3,455	9,326
5	Montgomery Ward	5322	8,652	-927	3,863	2,936
5	Penn-Dixie Cement	3241	7,107	1,854	3,476	5,330

TABLE 110 (Continued)

PORTFOLIO J 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
1	Plough	2830	3,080	15,400	933	16,333
3	Rayonier	0800	6,489	6,798	2,957	9,755
3	Rexall	2800	927	10,197	705	10,902
2	Rex Chainbelt	3531	4,928	10,472	3,259	13,731
	Total:		100,000	181,070	55,601	236,671

TABLE 111

PORTFOLIO K 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	American Crystal Sugar	2063	8,840	-2,340	2,075	-265
5	American Motors	3711	520	2,860	1,698	4,558
4	Amsted Industries	3740	3,640	6,500	4,121	10,621
1	Anchor Hocking Glass	3221	5,200	6,240	3,536	9,776
1	Avon Products	2844	1,040	18,200	1,212	19,412
4	Clevite	3714	3,900	10,400	3,780	14,180
4	De Vilbiss	3550	2,600	5,460	2,155	7,615
6	Duquesne Brewing	2082	1,560	260	1,209	1,469
4	Flintkote	2950	6,525	-261	2,918	2,657
3	Goodrich	3000	17,160	1,560	5,798	7,358
2	Grinnell	3430	8,320	43,420	4,740	48,160
4	Interstate Department Stores	5311	780	8,580	590	9,170
1	Kellogg	2000	2,340	8,840	2,226	11,066
4	Lone Star Brewing	2082	2,340	1,820	2,028	3,848
3	Medusa Portland Cement	3241	4,698	3,132	2,780	5,912
4	National Sugar Refining	2062	8,091	-4,176	1,527	-2,649

TABLE 111 (Continued)

PORTFOLIO K 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Newberry	5331	6,525	783	2,712	3,495
4	Purex	2899	783	8,874	1,039	9,913
5	St. Joseph Lead	1031	3,654	6,786	3,471	10,257
3	Tecumseh Products	3430	11,484	15,399	6,676	22,075
	Total:		100,000	142,337	56,291	198,628

TABLE 112

PORTFOLIO L 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Admiral	3651	2,610	13,920	548	14,468
8	Allen Electric Equipment	3714	1,740	13,920	131	14,051
7	American Airlines	4511	1,740	11,310	96	11,406
7	American Beverage	2086	870	4,350	0	4,350
4	American Enka	2823	2,610	33,930	6,447	40,377
5	American Motors	3711	1,740	4,350	5,681	10,031
8	Avco	3721	5,214	51,271	6,613	57,884
6	Avis Industrial	3679	1,740	6,960	705	7,665
8	Baldwin (D. H.)	3931	3,476	27,808	5,310	33,118
5	Braniff Airways	4511	2,610	11,310	479	11,789
3	British Petroleum	2913	3,480	2,610	2,288	4,898
4	Brown Forman	2085	1,740	17,400	2,140	19,540
6	Callahan Mining	9998	2,610	13,050	0	13,050
4	Cenco Instruments	3811	3,476	26,974	2,053	29,027
5	Cooper Tire & Rubber	3000	2,610	23,490	3,932	27,422
5	Crompton & Knowles	3550	1,740	13,050	4,907	17,957

TABLE 112 (Continued)

PORTFOLIO L 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Crown Cork & Seal	3221	2,610	50,460	0	50,460
4	Electrolux	3630	1,740	19,140	4,280	23,420
8	Ethyl	2899	1,740	31,320	2,010	33,330
8	Green Giant	2030	3,476	19,987	4,580	24,567
8	Grumman Aircraft Engineering	3721	5,214	26,939	4,727	31,666
8	Gulf & Western Industries	9998	870	50,460	470	50,930
5	Hamilton Watch	3871	2,610	11,310	3,097	14,407
6	Hat Corporation of America	2300	2,610	6,090	1,305	7,395
8	Heller (Walter E.)	6140	3,476	6,952	3,563	10,515
4	Hoover	3630	1,740	14,790	5,107	19,897
4	Host International	5812	870	45,240	1,740	46,980
5	Indian Head	2200	1,740	33,930	1,853	35,783
4	International Silver	3999	1,740	26,970	2,671	29,641
8	Kennametal	3399	4,345	34,760	3,685	38,445
5	Leesona	3550	1,740	34,800	2,279	37,079
8	McGraw-Hill	2731	6,083	34,760	3,476	38,236

TABLE 112 (Continued)

PORTFOLIO L 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
1	Magnavox	3651	1,740	33,060	3,332	36,392
8	National Airlines	4511	2,607	27,808	939	28,747
5	Northwest Airlines	4511	2,607	72,996	2,824	75,820
5	Pittsburgh Brewing	2082	1,740	8,700	2,793	11,493
7	Publicker	2085	3,476	5,214	0	5,214
3	Prentice-Hall	2700	1,740	28,710	2,071	30,781
2	Simplicity Pattern	2700	1,740	40,890	3,002	43,892
2	Xerox	3570	1,740	261,870	3,106	264,976
	Total:		100,000	1,202,859	104,240	1,307,099

TABLE 113

PORTFOLIO M 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	2,380	15,470	131	15,601
8	Allen Electric Equipment	3714	2,380	19,040	179	19,219
7	American Beverage	2086	1,191	5,955	0	5,955
4	American Enka	2823	3,570	46,410	8,818	55,228
5	American Motors	3711	2,380	5,950	7,771	13,721
8	Avco	3721	7,140	70,210	9,056	79,266
6	Avis Industrial	3679	2,380	9,620	964	10,484
8	Baldwin (D. H.)	3931	4,760	38,080	7,271	45,351
3	British Petroleum	2913	4,760	3,570	3,130	6,700
4	Brown Forman	2085	2,380	23,800	2,927	26,727
4	Cenco Instruments	3811	4,760	36,890	2,749	39,639
5	Crompton & Knowles	3550	2,380	17,850	6,712	24,562
8	Crown Cork & Seal	3221	3,570	69,020	0	69,020
4	Electrolux	3630	2,380	26,180	5,855	32,035
8	Ethyl	2899	2,380	42,840	2,749	45,589
8	Green Giant	2030	4,760	27,370	6,271	33,641

TABLE 113 (Continued)

PORTFOLIO M 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Grumman Aircraft Engineering	3721	7,146	36,921	6,479	43,400
8	Gulf & Western Industries	9998	1,191	69,078	643	69,721
6	Hat Corporation of America	2300	3,573	8,337	1,787	10,124
8	Heller (Walter E.)	6140	4,764	9,528	4,883	14,411
4	Hoover	3630	2,382	20,247	6,991	27,238
4	Host International	5812	1,191	61,932	2,382	64,314
5	Indian Head	2200	2,382	46,449	2,537	48,986
4	International Silver	3999	2,382	36,921	3,656	40,577
8	Kennametal	3399	5,955	47,640	5,050	52,690
5	Leesona	3550	2,382	47,640	3,120	50,760
8	National Airlines	4511	3,573	38,112	1,286	39,398
5	Pittsburgh Brewing	2082	2,382	11,910	3,823	15,733
3	Prentice-Hall	2700	2,382	39,303	2,835	42,138
7	Publicker	2085	4,764	7,146	0	7,146
	Total:		100,000	939,319	110,055	1,049,374

TABLE 114

PORTFOLIO N 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	2,564	16,666	141	16,807
8	Allen Electric Equipment	3714	2,564	20,512	192	20,704
7	American Beverage	2086	1,282	6,410	0	6,410
5	American Motors	3711	2,564	6,410	8,371	14,781
8	Avco	3721	7,692	75,638	9,756	85,394
6	Avis Industrial	3679	2,564	10,256	1,038	11,294
8	Baldwin (D. H.)	3931	5,128	41,024	7,833	48,857
3	British Petroleum	2913	5,128	3,846	3,372	7,218
4	Brown Forman	2085	2,564	25,640	3,154	28,794
4	Cenco Instruments	3811	5,128	39,742	2,961	42,703
5	Crompton & Knowles	3550	2,564	19,230	7,230	26,460
8	Crown Cork & Seal	3221	3,846	74,356	0	74,356
4	Electrolux	3630	2,564	28,204	6,307	34,511
8	Ethyl	2899	2,564	46,152	2,961	49,113
8	Green Giant	2030	5,128	29,486	675	36,242
8	Grumman Aircraft Engineering	3721	7,692	39,742	6,974	46,716

TABLE 114 (Continued)

PORTFOLIO N 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Gulf & Western Industries	9998	1,282	74,356	692	75,048
8	Heller (Walter E.)	6140	5,128	10,256	5,256	15,512
4	Hoover	3630	2,564	21,794	7,525	29,319
4	Host International	5812	1,282	66,664	2,564	69,228
5	Indian Head	2200	2,564	49,998	2,731	52,729
4	International Silver	3999	2,564	39,742	3,936	43,678
8	Kennametal	3399	6,410	51,280	5,436	56,716
5	Leesona	3550	2,564	51,280	3,359	54,939
8	National Airlines	4511	3,846	41,024	1,385	42,409
5	Pittsburgh Brewing	2082	2,564	12,820	4,115	16,935
3	Prentice-Hall	2700	2,564	42,306	3,051	45,357
7	Publicker	2085	5,132	7,698	0	7,698
	Total:		100,000	952,532	107,096	1,059,628

TABLE 115

PORTFOLIO O 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	3,126	20,319	172	20,491
8	Allen Electric Equipment	3714	3,126	25,008	234	25,242
7	American Beverage	2086	1,563	7,815	0	7,815
5	American Motors	3711	3,126	7,815	10,206	18,021
6	Avis Industrial	3679	3,126	12,504	1,266	13,770
8	Baldwin (D. H.)	3931	6,252	50,016	9,550	59,566
3	British Petroleum	2913	6,252	4,689	4,111	8,800
4	Brown Forman	2085	3,126	31,260	3,845	35,105
4	Cenco Instruments	3811	6,252	48,453	3,611	52,084
5	Crompton & Knowles	3550	3,126	23,445	8,815	32,260
8	Crown Cork & Seal	3221	4,689	90,654	0	90,654
4	Electrolux	3630	3,126	34,386	7,690	42,076
8	Ethyl	2899	3,126	56,268	3,611	59,879
8	Green Giant	2030	6,248	35,926	8,232	44,158
8	Gulf & Western Industries	9998	1,562	90,596	843	91,439
8	Heller (Walter E.)	6140	6,248	12,496	6,404	18,900

TABLE 115 (Continued)

PORTFOLIO O 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
4	Hoover	3630	3,124	26,554	9,169	35,723
4	Host International	5812	1,562	81,224	3,124	84,348
5	Indian Head	2200	3,124	60,918	3,327	64,245
4	International Silver	3999	3,124	48,422	4,795	53,217
8	Kennametal	3399	7,810	62,480	6,623	69,103
5	Leesona	3550	3,124	62,480	4,092	66,572
8	National Airlines	4511	4,686	49,984	1,687	51,671
5	Pittsburgh Brewing	2082	3,124	15,620	5,014	20,634
7	Publicker	2085	6,248	9,372	0	9,372
	Total:		100,000	968,704	106,421	1,075,125

TABLE 116

PORTFOLIO P 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
7	Alleghany Airlines	4511	3,922	25,493	216	25,709
8	Allen Electric Equipment	3714	3,922	31,376	294	31,670
7	American Beverage	2086	1,961	9,805	0	9,805
5	American Motors	3711	3,922	9,805	12,805	22,610
6	Avis Industrial	3679	3,922	15,688	1,588	17,276
8	Baldwin (D. H.)	3931	7,844	62,752	11,982	74,734
3	British Petroleum	2913	7,844	5,883	5,157	11,040
4	Cenco Instruments	3811	7,844	60,791	4,628	65,419
5	Crompton & Knowles	3550	3,922	29,475	11,060	40,475
8	Crown Cork & Seal	3221	5,883	113,738	0	113,738
8	Ethyl	2899	3,922	70,596	4,530	75,126
8	Green Giant	2030	7,844	45,103	10,334	55,437
8	Gulf & Western Industries	9998	1,961	113,738	1,059	114,797
8	Heller (Walter E.)	6140	7,844	15,688	8,040	23,728
4	Host International	5812	1,961	101,972	3,922	105,894
5	Indian Head	2200	3,922	76,479	4,177	80,656

TABLE 116 (Continued)

PORTFOLIO P 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
5	Leesona	3550	3,920	78,400	5,135	83,535
8	National Airlines	4511	5,880	62,720	2,117	64,837
5	Pittsburgh Brewing	2082	3,920	19,600	6,292	25,892
7	Publicker	2085	7,840	11,760	0	11,760
	Total:		100,000	960,802	93,336	1,054,138

TABLE 117

PORTFOLIO Q 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
1	Avon Products	2844	3,032	104,604	4,798	109,402
4	Belden	3400	4,548	26,530	4,700	31,230
2	Black & Decker	3550	4,548	36,384	4,495	40,879
4	Burlington Industries	2200	3,790	25,772	5,162	30,934
1	Bristol-Myers	2830	3,032	53,060	3,532	56,592
1	Chesebrough Pond's	2844	3,790	27,288	3,411	30,699
3	Coca-Cola Bottling NY	2086	6,822	10,612	7,042	17,654
8	Collins Radio	3670	6,822	68,220	1,652	69,872
1	Consolidated Cigars	2121	3,790	15,918	5,935	21,853
7	Curtis Publishing	2700	6,813	2,271	568	2,839
8	GAF	2800	6,813	10,598	833	11,431
8	General Finance	6145	7,570	7,570	5,920	13,490
5	Giant Yellowknife	1042	3,032	4,548	4,442	8,990
3	Gimbel Brothers	5311	3,790	26,530	5,056	31,586
2	Lane Bryant	5600	4,548	18,950	5,200	24,150
5	Parker Hannifin	3560	3,032	40,932	4,252	45,184

TABLE 117 (Continued)

PORTFOLIO Q 1958-1967 RESULTS, EQUAL SHARES STRATEGY

Risk Class	Company	Industry Number	Initial Investment ($)	Capital Gain ($)	Dividend Income ($)	Total Return ($)
8	Rohr	3725	6,813	19,682	5,102	24,784
8	Talcott (James)	6140	6,813	9,841	6,828	16,669
8	Thiokol Chemical	3721	7,570	7,570	492	8,062
1	Zenith	3651	3,032	40,174	5,708	45,882
	Total:		100,000	557,054	85,128	642,182

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BIOGRAPHICAL SKETCH

Alfred Louis Kahl, Jr., was born October 4, 1932 at Michigan City, Indiana. In June 1950 he was graduated from Isaac C. Elston Senior High School. He served in the United States Air Force from 1951 to 1961. In June 1960 he received the degree of Bachelor of Arts, with honors, from the University of Maryland. In 1961 he was awarded a fellowship for graduate study at the University of Pittsburgh where he received the degree of Master of Business Administration in August 1962. During the academic year 1962-63 he was Instructor in Management at Gannon College, Erie, Pennsylvania. In the summer of 1963 he enrolled in the Graduate School of the University of Florida where he pursued his course work toward the degree of Doctor of Philosophy. Since September 1965 he has been Assistant Professor of Finance at the University of Georgia.

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This dissertation was prepared under the direction of the chairman of the candidate's supervisory committee and has been approved by all members of that committee. It was submitted to the Dean of the College of Business Administration and to the Graduate Council, and was approved as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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